8 JULY 1954

NINEPENCE

ELECTRICAL TIMES

The First

110 kV 3-core

Oil-Filled Cable

in the United Kingdom

Henley's are supplying and installing approximately 7 miles of 0·30 sq. in. 3-core 110 kV. Oil-Filled Cable, together with auxiliary cables and accessories to link the Belfast Municipal Electric Power Station West with the System of the Electricity Board for Northern Ireland at Donegall Sub-station.

This 110 kV. 3-core cable is the highest voltage 3-core cable of the oil-filled type manufactured in this country.

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Benjamin lighting gives maximum 'visual comfort'
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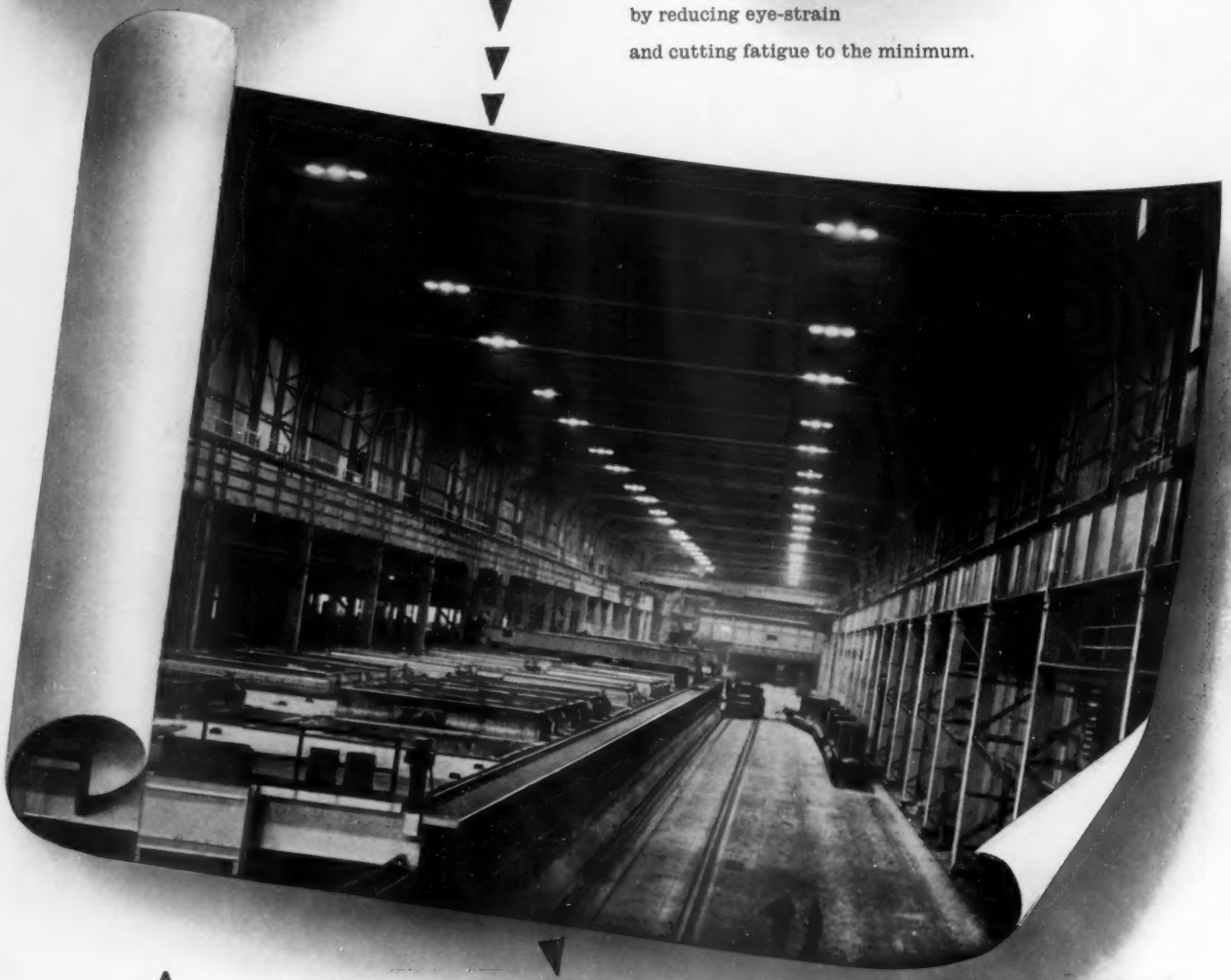

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an expert survey will be carried out,
every detail studied and
a plan submitted that will ensure—

Better Lighting—by BENJAMIN REGD

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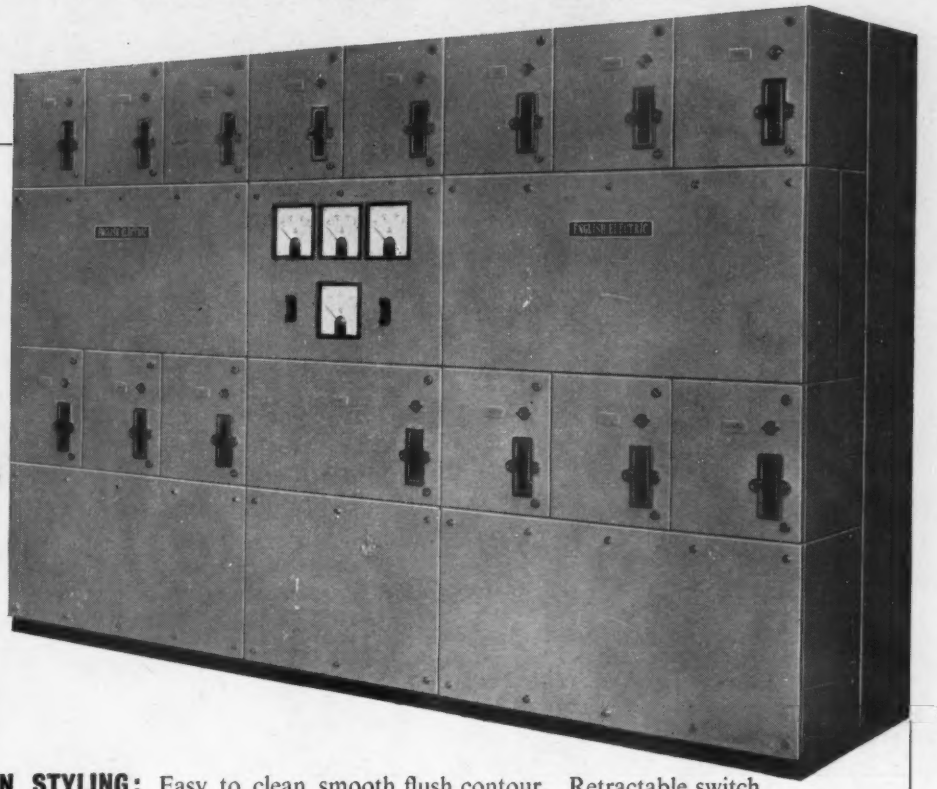
for the control of MEDIUM VOLTAGE circuits

Incorporating H.R.C. CHASSIS TYPE FUSE-SWITCHES in ratings up to 750 amps.



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SAFETY FEATURES: Busbars, connections and terminals fully insulated. Potential circuits fused at supply point. Integral cylinder locks fitted to fuse-switches.

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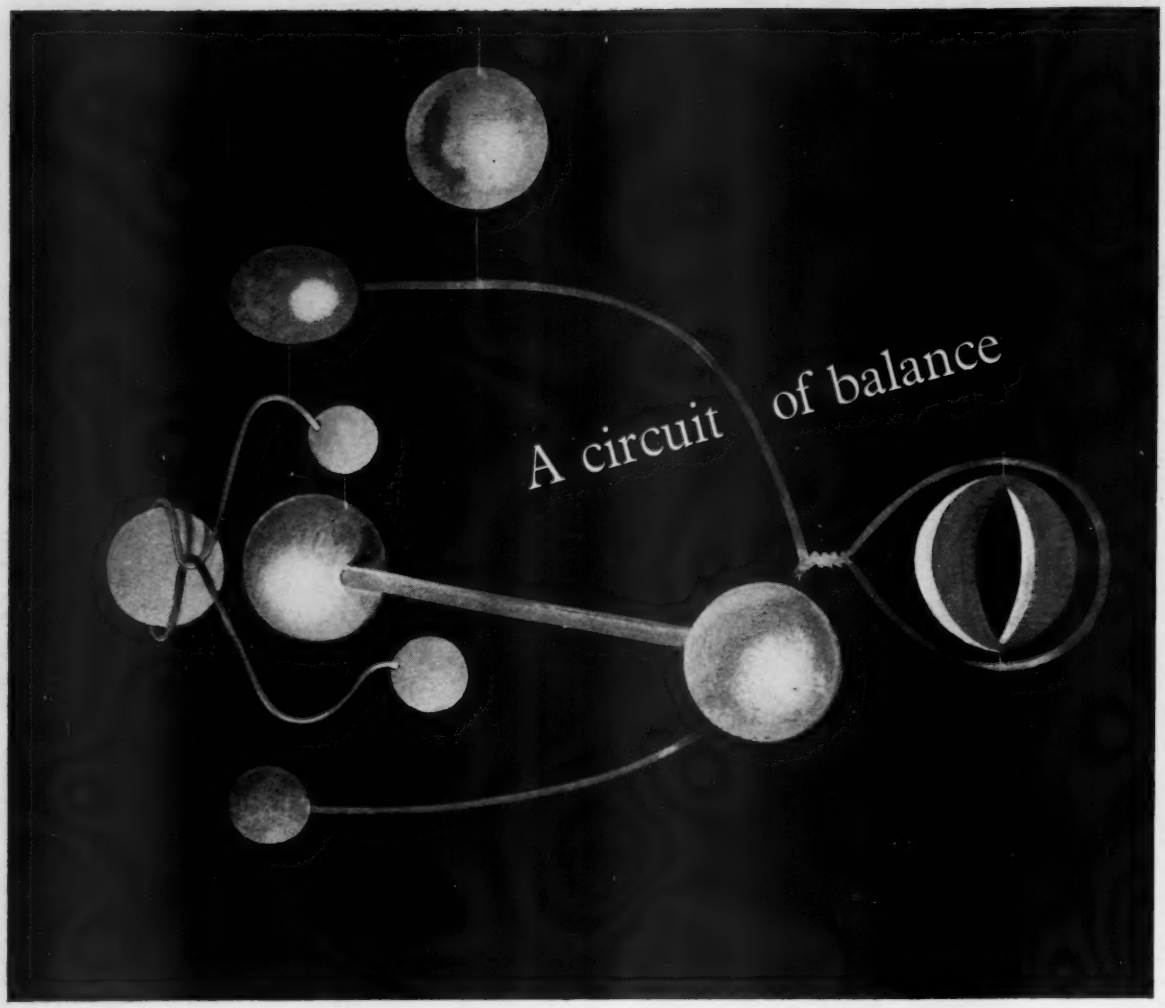

TAKE A LOOK AT THIS MOBILE*. It has nothing to do with electricity. Yet it is a circuit — and circuits are important to us. Our business — and most likely yours — could not exist without them. Within our domain are all the constituents of a complete, balanced circuit. We make the plant that makes the current, that carries the current that moderates the current that measures the current that controls the current that drives the wheels of industry into the future. We are the house that Crompton built — seventy-five years ago.

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** Just in case someone might read this and think we have left something out, let us explain that 'mobile' can be a noun as well as an adjective. It is a word used to describe a display of shapes that, like Crompton Parkinson, never stops moving to a good purpose.*

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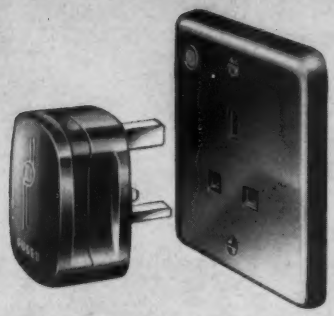

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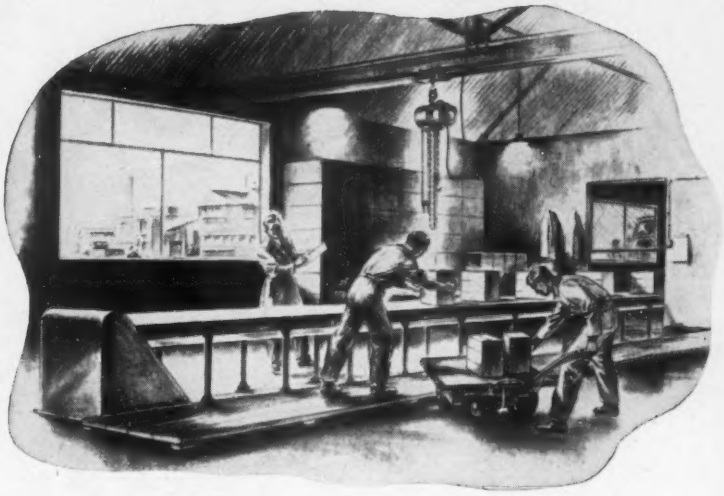

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The endless processes which make up the industrial picture demand a reliable source of mechanical power. In the multitude of applications where a drive of between one thousandth of a horsepower and one horsepower is required, BTH "fractionals" provide economical service with the minimum of maintenance. A.C. (single and three-phase) and D.C. motors are manufactured with a variety of mountings to suit any duty, and are designed for power supplies up to 550 volts.

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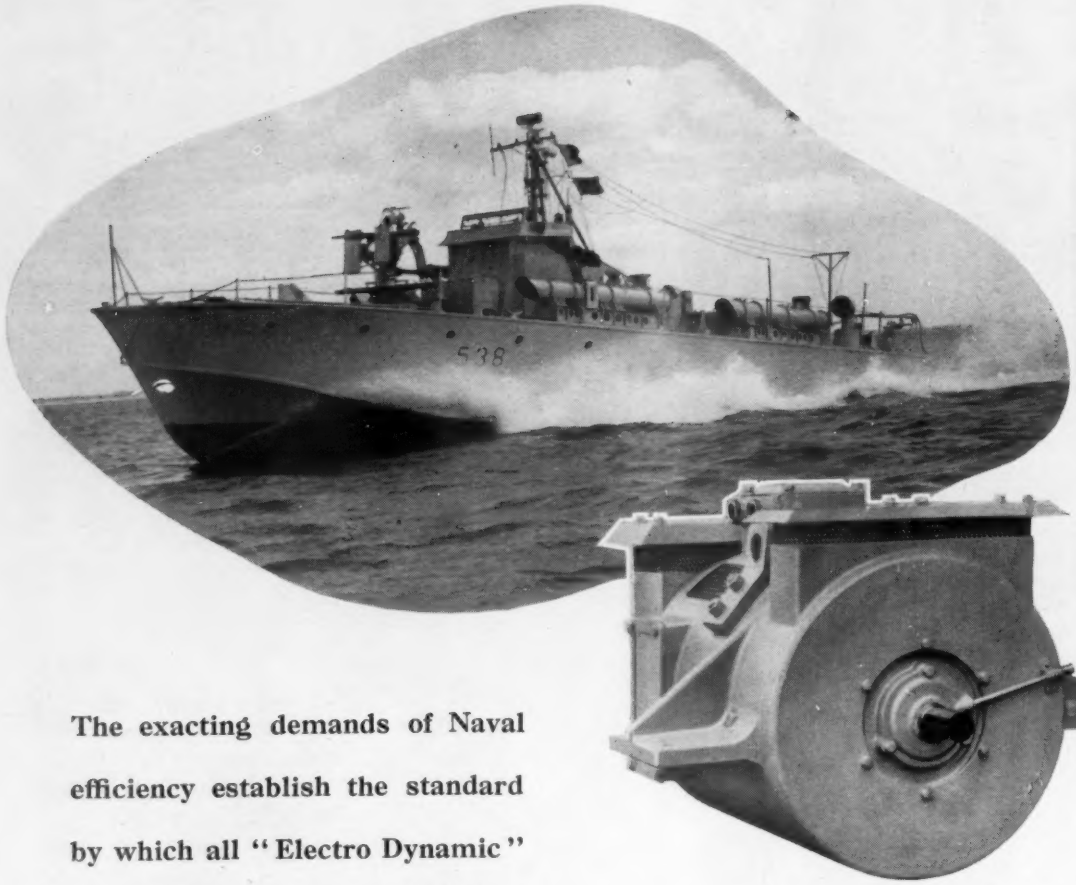

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Light weight Marine Generator, 35 kW. 1,850 r.p.m., 220 volts. Drip-proof Enclosed Ventilated. 680 lb. weight.

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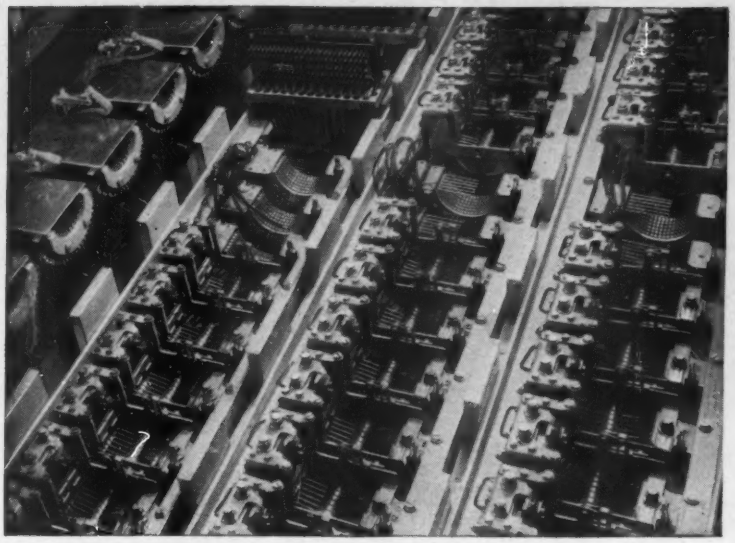

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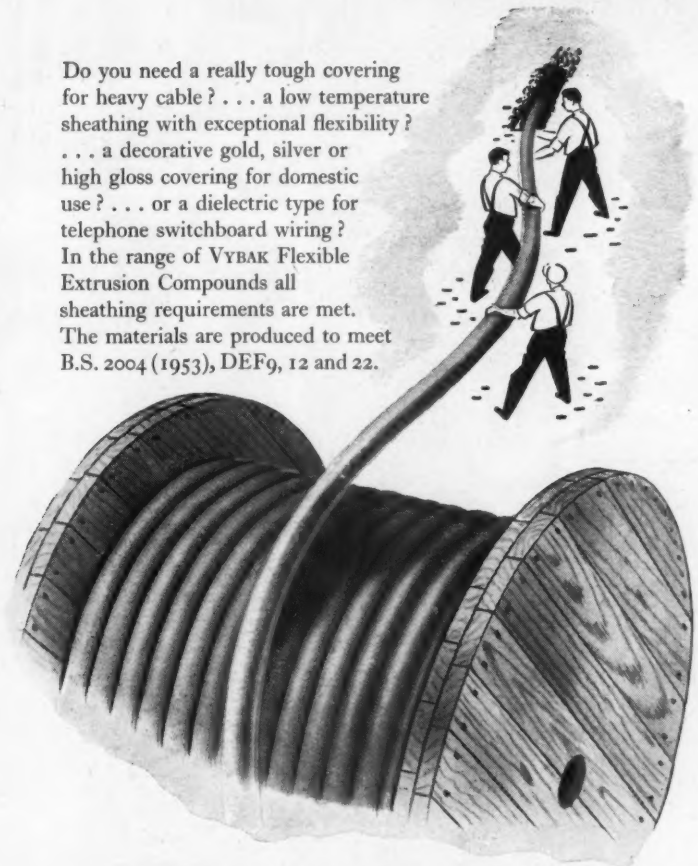

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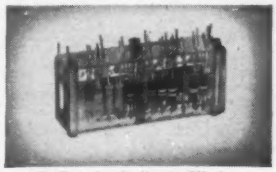
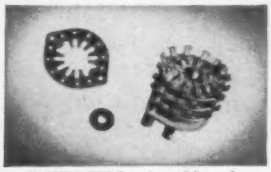


Radio circuit "potted" in BAKELITE Polyester Resin



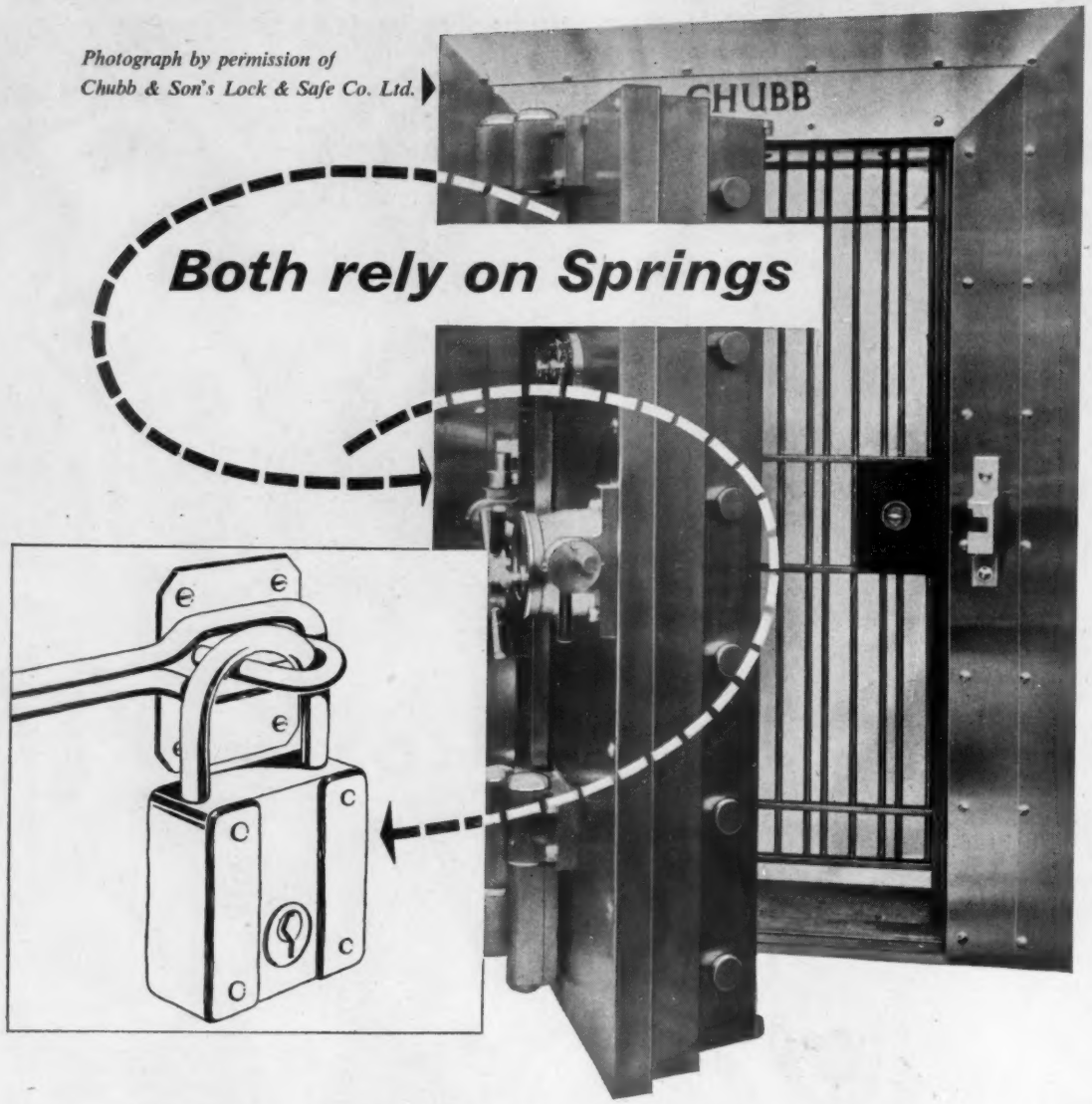
BAKELITE Laminated is used for insulation of switches etc.

BAKELITE Cements bond the base to the cathode tube

B

C3

Photograph by permission of Chubb & Son's Lock & Safe Co. Ltd.



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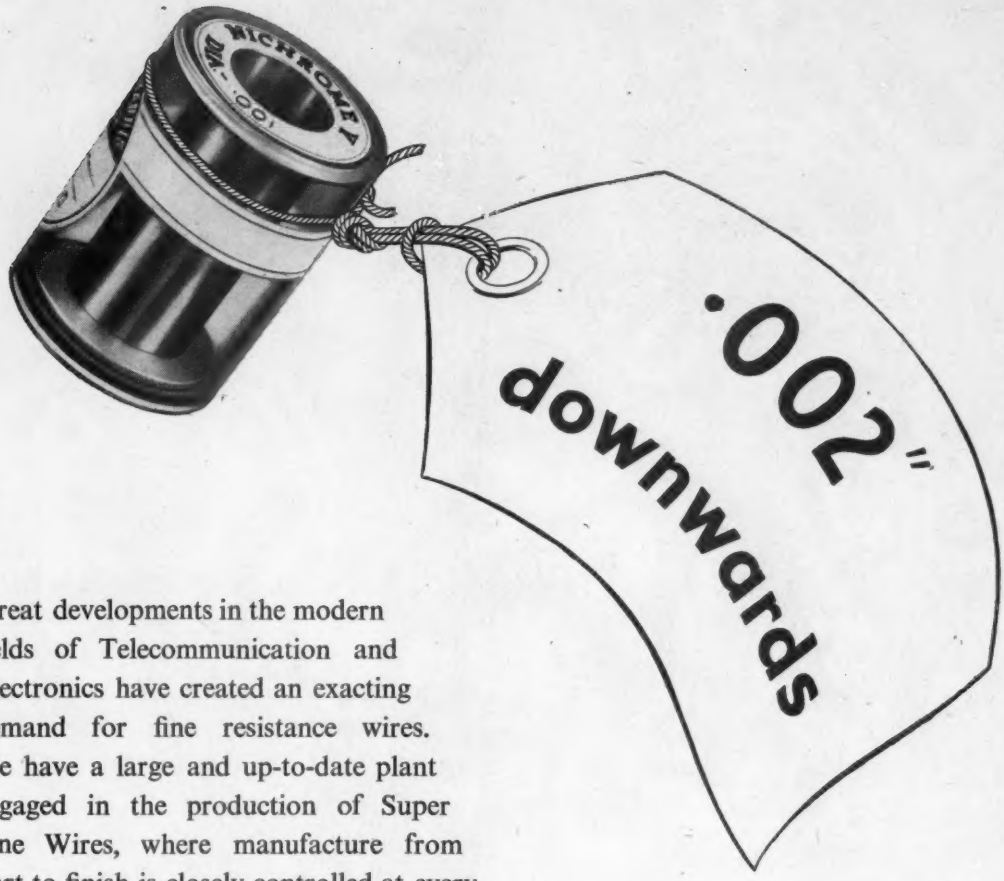

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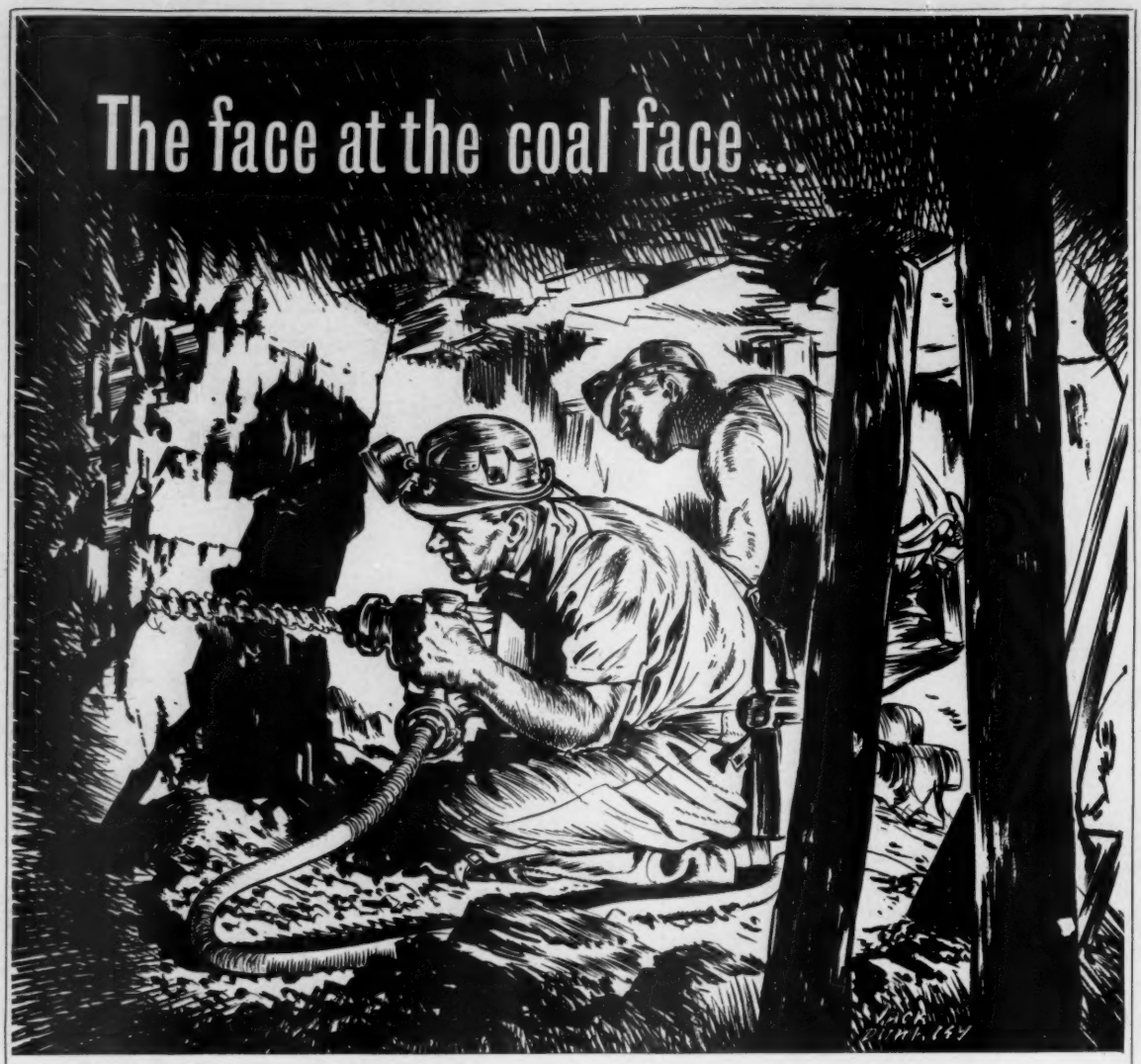

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VERSCO SQUARE DE LUXE BOILER. This smart and compact boiler is fitted with castors for easy movement and is finished in cream stove enamel. The table-top in cream vitreous is an attractive feature.

VERSCO ROUND BOILER. Obtainable in Galvanised finish as shown (a most durable finish of special appeal for Corporation and other housing schemes) or in cream stove enamel.

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Grade TH Permali is introduced only after exhaustive testing and Laboratory research. A marked improvement in moisture resistance has been achieved without seriously altering the outstanding electrical and mechanical properties of the well-known Grade EH Permali.
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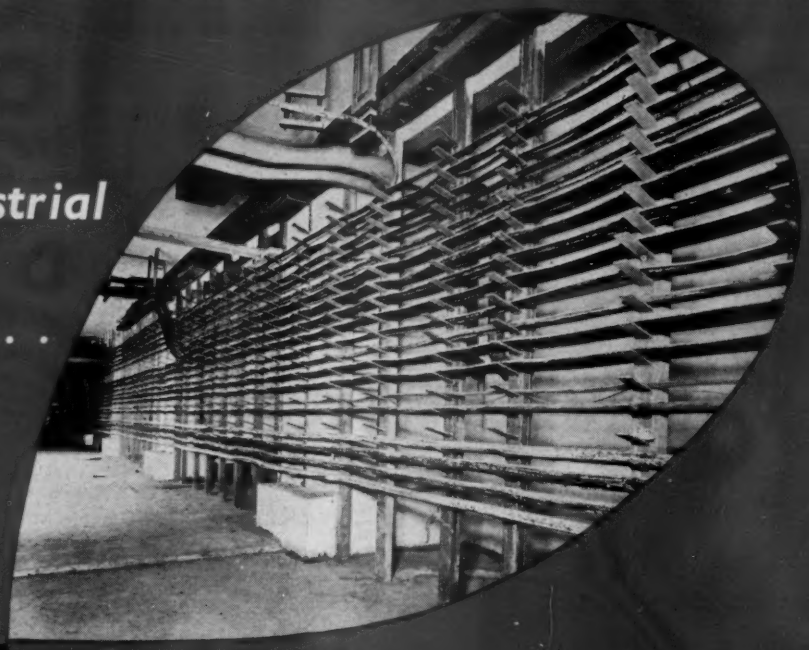
from Industrial Cabling . . .



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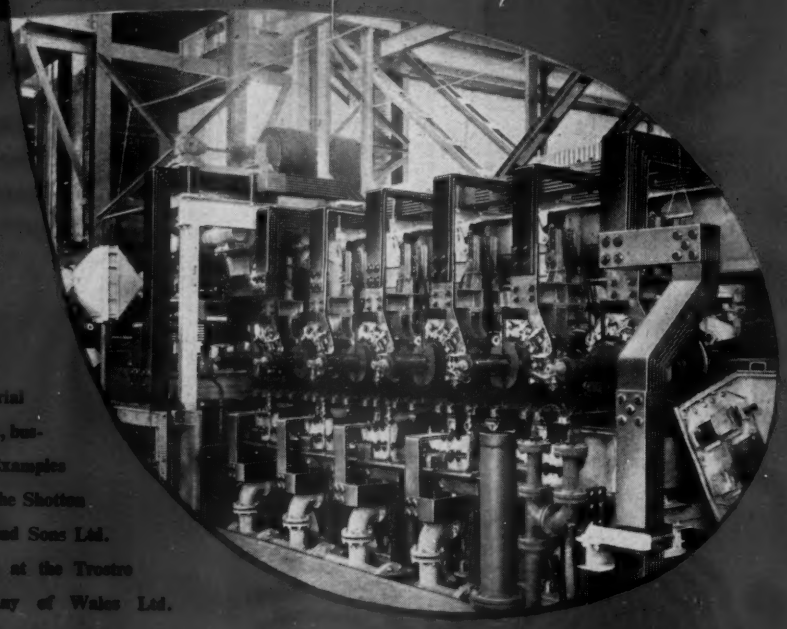

to Busbars

Many of Britain's largest industrial plants are served by BICC cables, busbars and associated equipment. Examples here show power cable runs at the Shotton Steelworks of John Summers and Sons Ltd. and copper busbar installations at the Trostre Works of the Steel Company of Wales Ltd. We design, supply and install cables and associated equipment for use wherever electric power is needed in factories—a part of the BICC World Service to Industry.

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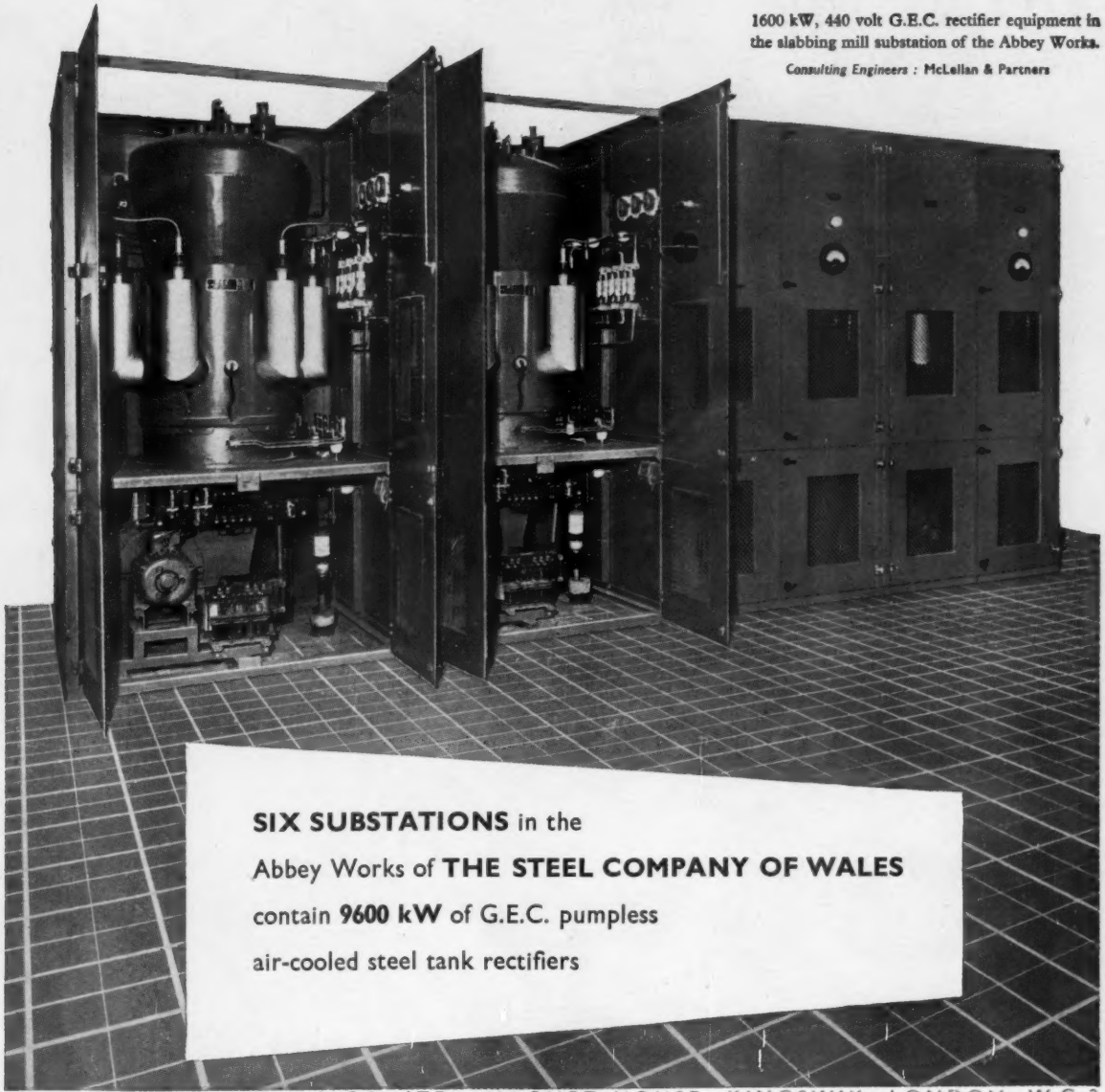
G.E.C.

Steel Tank Rectifiers

FOR STEELWORKS



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Consulting Engineers : McLellan & Partners

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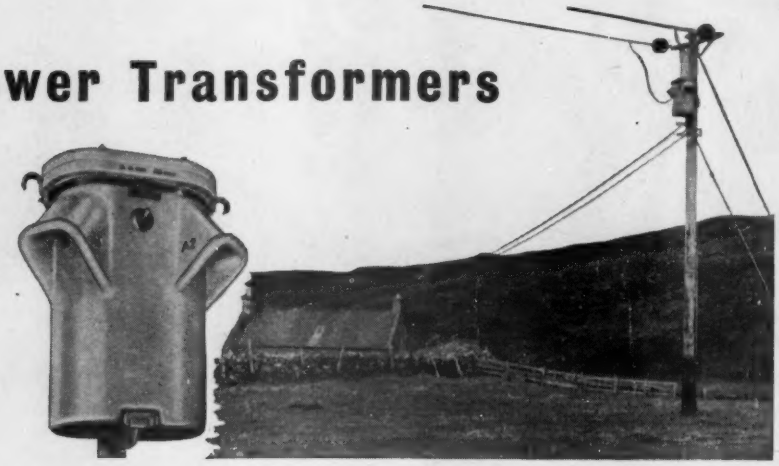
for rural distribution

in hermetically-sealed stoneware containers



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- No maintenance costs. Containers are salt and acid proof. Supporting steel work is heavily galvanised. Hermetically sealed container protects oil from acidity.
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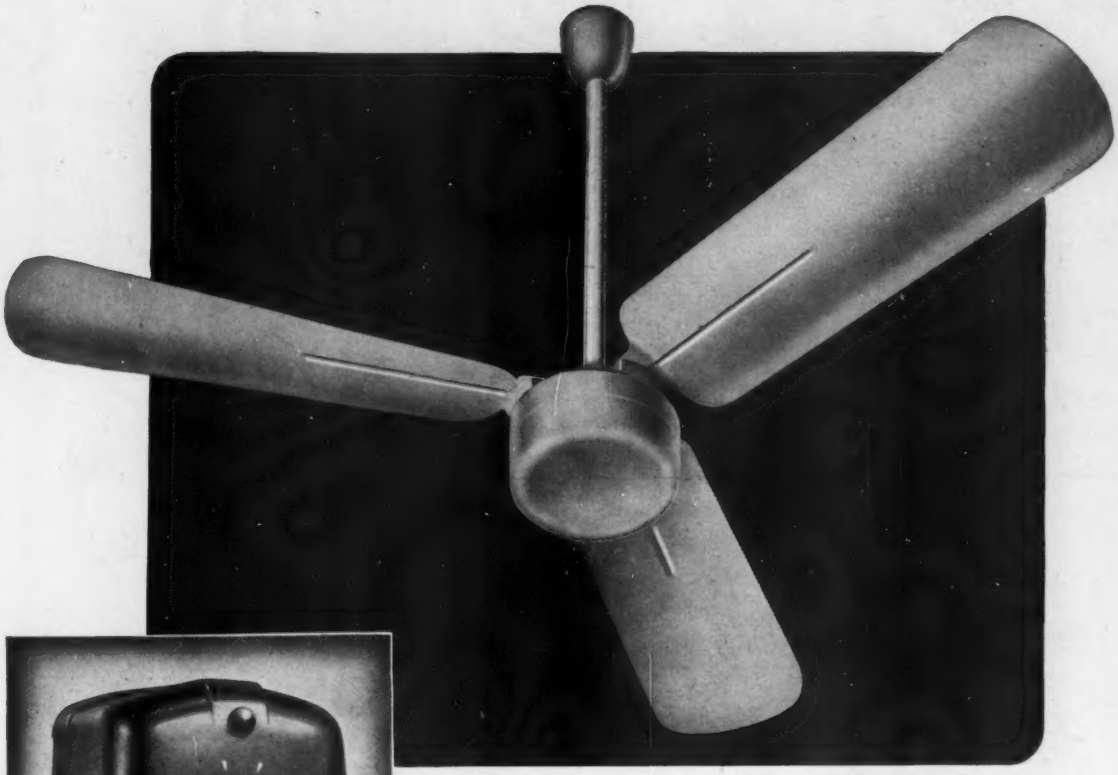

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BIRMINGHAM ENGLAND

698

I will be there . . .
after your castings arrive

to give you practical advice on problems that can arise during machining. I am a practical foundryman and my job is to call on customers after our castings have been delivered to sort out "on the spot" machine or location difficulties, or to discuss any modifications required during long runs. This is another of the extra facilities that you get from Birmal.

Our Research and Development Staff will give experienced help in the development of cast components and unbiassed assistance in the selection of the right alloy and casting process. Birmal give you co-operation from start to finish—specialised attention before, during and after fabrication. That is why

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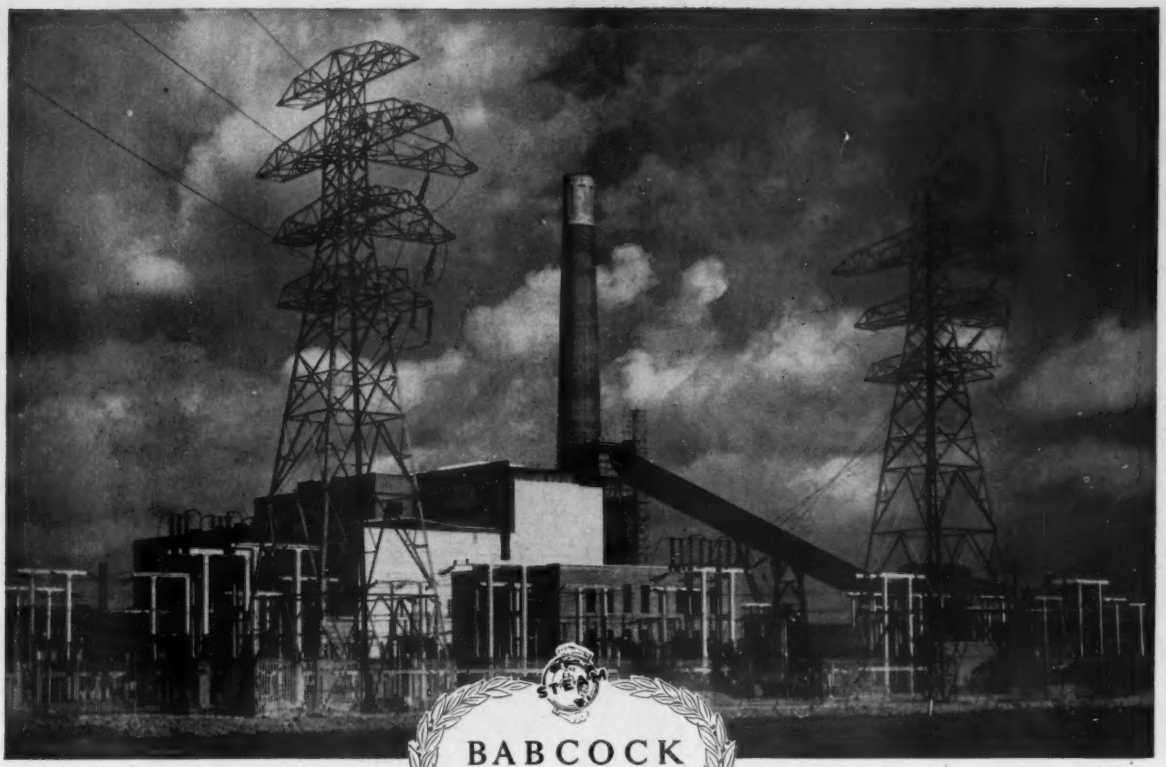

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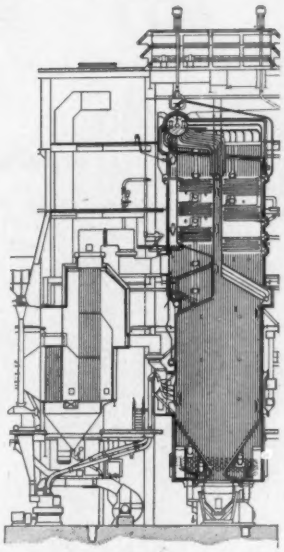
B.E.A. NORTH WESTERN DIVISION

The Babcock boilers at the new 240 MW. Carrington power station are Radiant units, each with an evaporation of 360,000 lb./hr. at 940 lb./sq. in. and 920°F., and fired with pulverized coal by means of eight horizontal intertube burners.

The contract includes all the coal pulverizing plant, comprising 28 Babcock type E mills to feed seven boilers.



Ash, collected in the 'A' type water-filled hoppers is discharged to sump by the "*Hydrojet*" system, being pumped to settling ponds by "*Hydroseal*" ash pumps. Dust is extracted from the precipitator and air-heater hoppers by the "*Hydrovac*" system. All this is Babcock equipment, widely used in both power station and industrial installations.

Babcock & Wilcox, the world's largest manufacturers of steam-raising plant, offer to steam users large or small a comprehensive, world-wide service embracing everything for steam generation from fuel handling to ash and dust disposal.

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Good delivery — Low prices.
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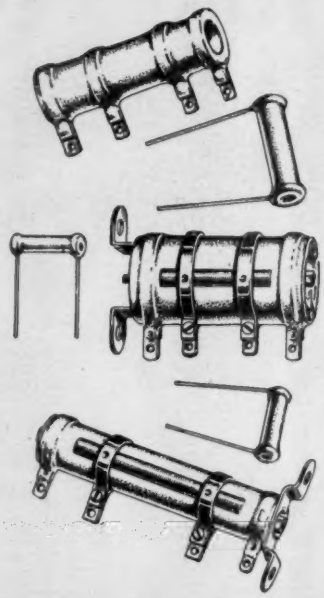

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The BEST IN BRASS BAYONET HOLDERS by Sperryn TRADE MARK

SPERRYN & CO. LTD. MOORSOM ST. BIRMINGHAM 6

Electrical Times, 8 July, 1954

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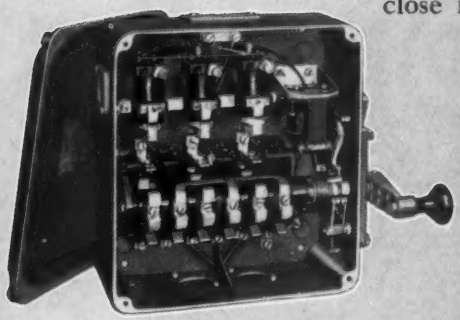
. . . a METROVICK ASD is best

The ASD series of Metrovick starters is not only made to B.S. 587 but to the standard of design and construction which Metrovick rigorously maintain in all their products. The ASD starter invites close inspection. Full technical details will be sent on request.



Type ASD starters are suitable for squirrel-cage motors up to 25 H.P., 650 V. The starters are intended for use in general industrial applications.

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We welcome your enquiries

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Produced in response to a demand for a high sensitivity version of the world-famous Universal AvoMeter, this model incorporates the traditional design features of its predecessors, so highly valued for simplicity of operation and compact portability.

It has a sensitivity of 20,000 ohms per volt on all D.C. voltage ranges and 1,000 ohms per volt on A.C. ranges from 100 V upwards. A decibel scale is provided for audio frequency tests. In addition, a press button has been incorporated which reverses the direction of current through the moving coil, and thus obviates the inconvenience of changing over test leads when the current direction reverses. It also simplifies the testing of potentials, both positive and negative, about a common reference point. A wide range of resistance measurements can be made using internal batteries, separate zero adjustment being provided for each range.

It is of importance to note that this model incorporates the "AVO" automatic cut-out for protection against inadvertent overloads.

Size 8¼" x 7½" x 4½"
Weight 6½lbs. (including leads)

£23 : 10s.

For your Valve Characteristic Meter or Valve Tester

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D.C. VOLTAGE	D.C. CURRENT	A.C. VOLTAGE	A.C. CURRENT	RESISTANCE
				First indication 0·5Ω. *Maximum indication* 20MΩ.
2·5V.	50μA.	2·5V.	100mA.	0—2,000Ω { using internal batteries.
10V.	250μA.	10V.	1A.	0—200,000Ω { using internal batteries.
25V.	1mA.	25V.	2·5A.	0—20MΩ { using internal batteries.
100V.	10mA.	100V.	10A.	0—200MΩ { using external batteries.
250V.	100mA.	250V.	—	
1,000V.	1A.	1,000V.	—	
2,500V.	10A.	2,500V.	—	

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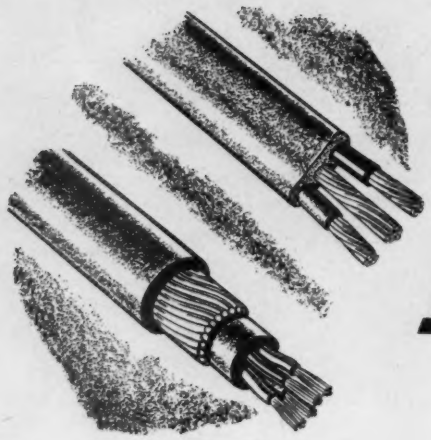
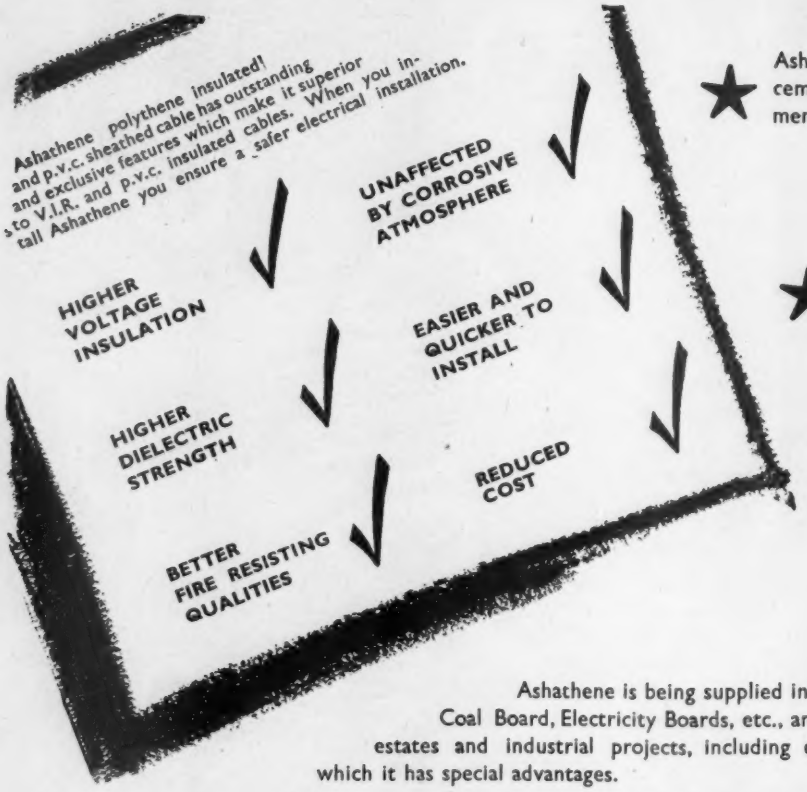


A BETTER ELECTRICAL INSTALLATION AT LOWER COST WITH ASHATHENE CABLE


Ashathene polythene insulated and p.v.c. sheathed cable has outstanding and exclusive features which make it superior to V.I.R. and p.v.c. insulated cables. When you install Ashathene you ensure a safer electrical installation.
UNAFFECTED BY CORROSIVE ATMOSPHERE
HIGHER VOLTAGE INSULATION
EASIER AND QUICKER TO INSTALL
HIGHER DIELECTRIC STRENGTH
REDUCED COST
BETTER FIRE RESISTING QUALITIES

★ Ashathene can be laid directly into cement or plaster without any detrimental effect occurring.

★ Ashathene is also available with single or double wire armouring with an overall p.v.c. sheath in a wide range. Special sealing glands are available which positively prevent moisture ingress into distribution boxes, etc.

Ashathene is being supplied in large quantities to the National Coal Board, Electricity Boards, etc., and is extensively used in housing estates and industrial projects, including chemical and plating works for which it has special advantages.

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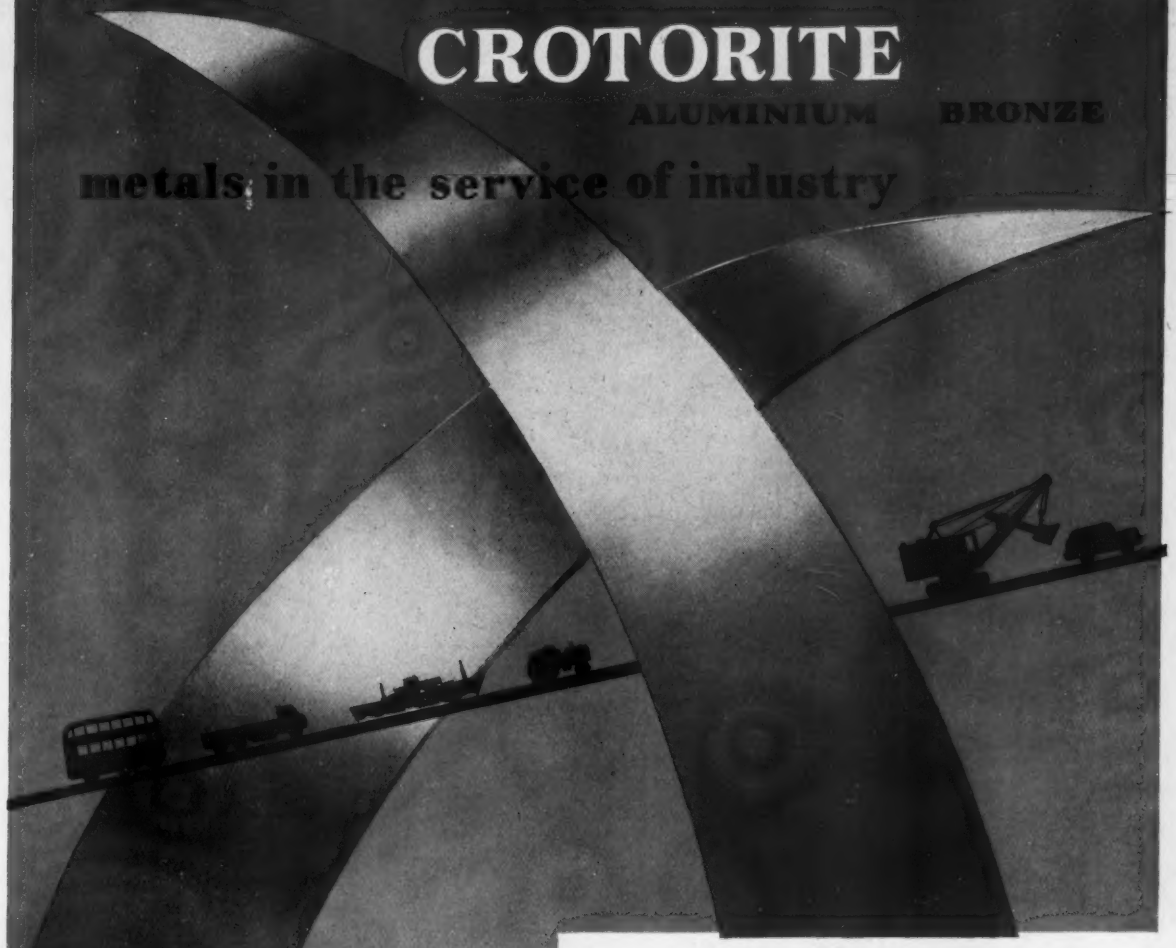

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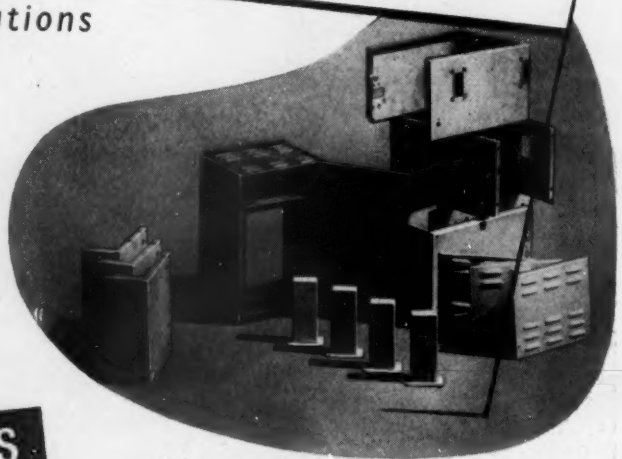
Whatever your particular needs in Metal Fabrication and Specialised Precision Work, our long experience in association with the electrical industry enables us to meet your most exacting requirements with speed and efficiency. Our productions include Control Panels, Cabinets, Transformer Tanks, Chassis Assemblies, Components and all kinds of Pressings and Fabrications for every application.

We welcome enquiries and we are always pleased to advise on any Specialised Metal Fabrication Problem without obligation.



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British Patent Nos. 627815 & 627793.

Photograph taken in the switchroom of the B.E.A.'s Carmarthen Bay Generating Station. Contractors: Messrs. R. Alger & Sons Ltd. Newport, Mon.

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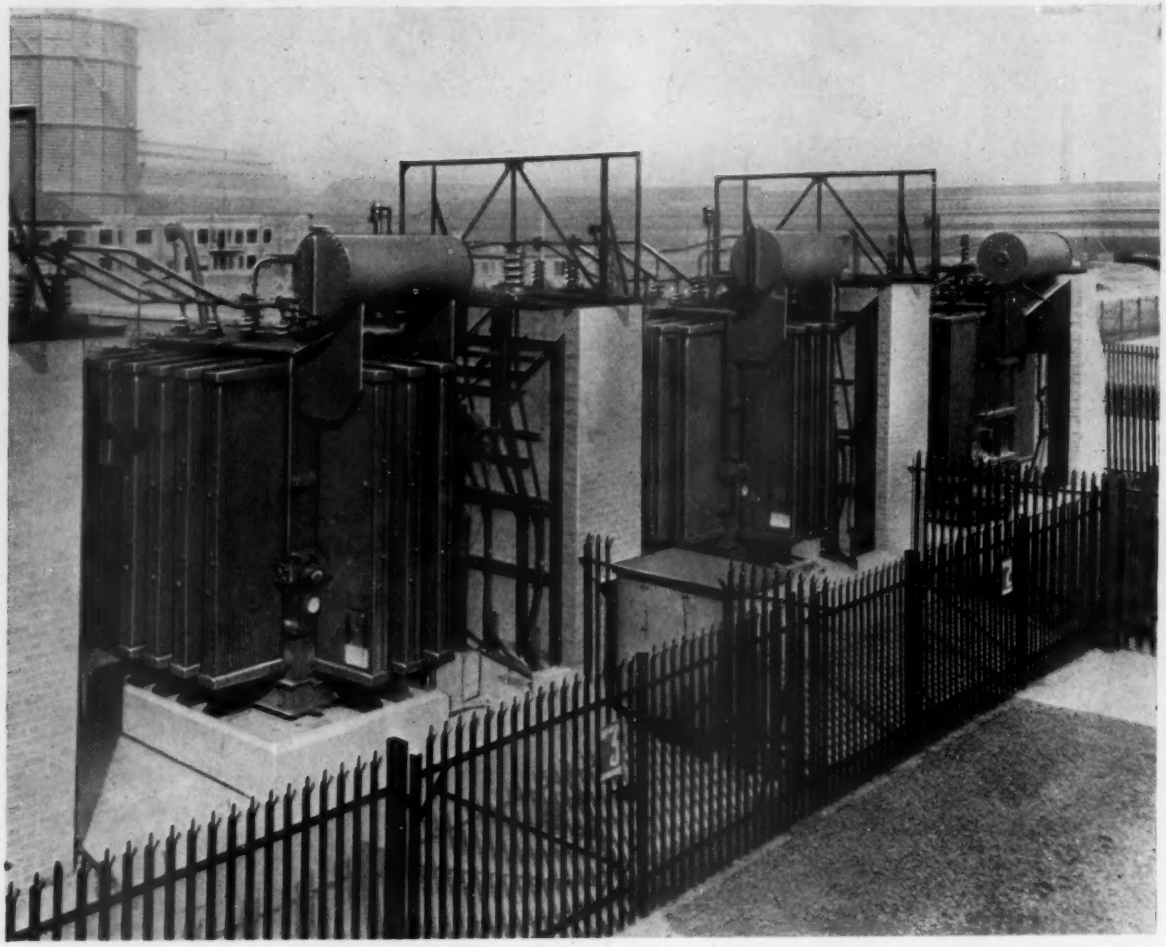

Brush transformers of 15,000 kVA installed in a large British steelworks.

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Over a period of years special attention has been given by our designers to the transformer requirements of iron and steelworks. Furnace transformers and heavy current units for heat treatment and other special requirements can be supplied to customer's specifications. A large number of installations have been effected in this country and in many parts of the world for general power distribution and furnace work.

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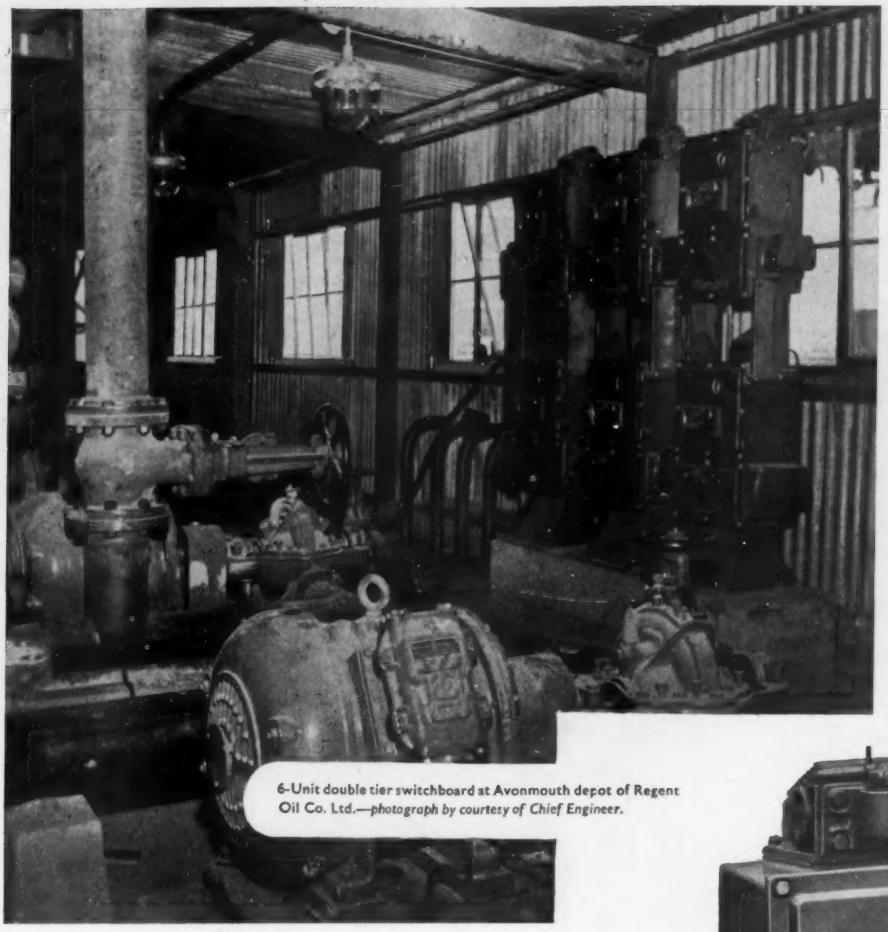
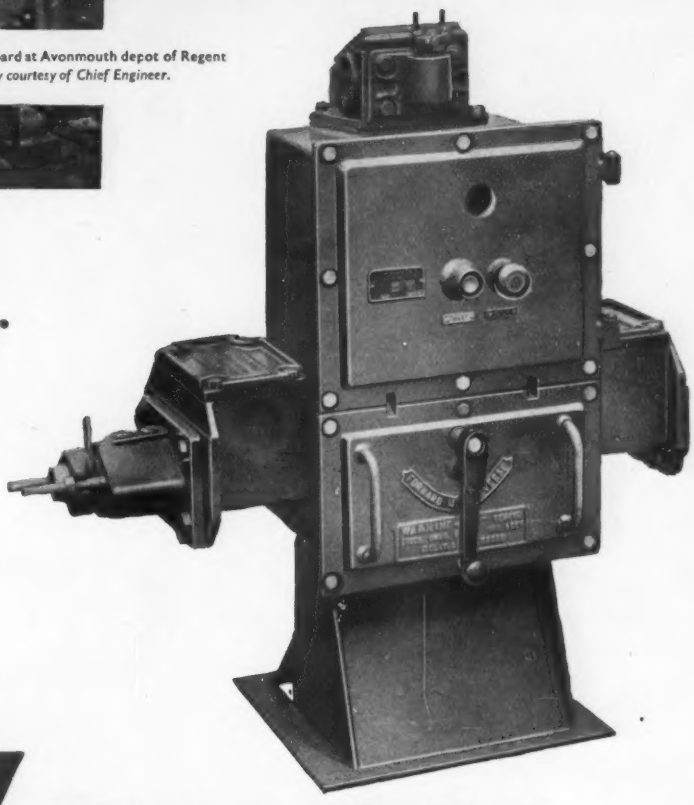


6-Unit double tier switchboard at Avonmouth depot of Regent Oil Co. Ltd.—*photograph by courtesy of Chief Engineer.*



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flameproof contactor starter

30 Amp (Up to 650 volts A.C.)
Certified for Groups I & II Gases
Single or Double Tier formation

- Throughgoing busbar capacity of 200 amps.
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- Back-up H.R.C. fuse protection optional.
- Hinged interior arrangement provides complete accessibility.

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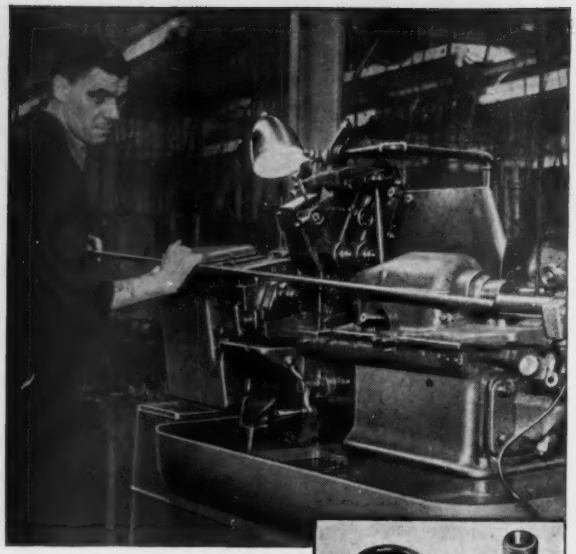

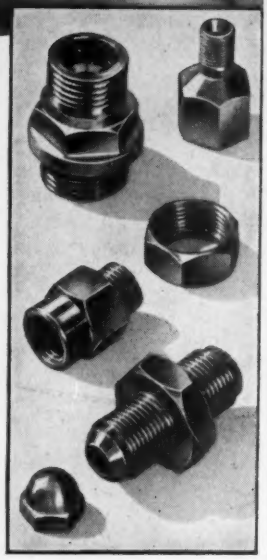

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No. 4 Turning and Screwing Brass Rods

Ever higher speeds demand ever greater precision—and British industry needs both if production is to be increased and costs reduced. McKechnie Brothers have developed a range of standard high-speed turning and screwing rods, including the popular **No. 4** and **YS,** all of which are guaranteed to combine the correct alloy and temper for maximum machine speeds and longest tool life. For full details of these and other MKB free machining rods please write to—

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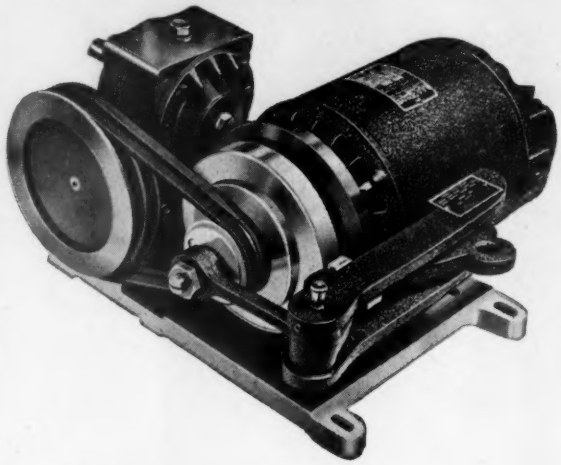
MARDRIVE REG'D

CLUTCH WORM REDUCTION UNIT



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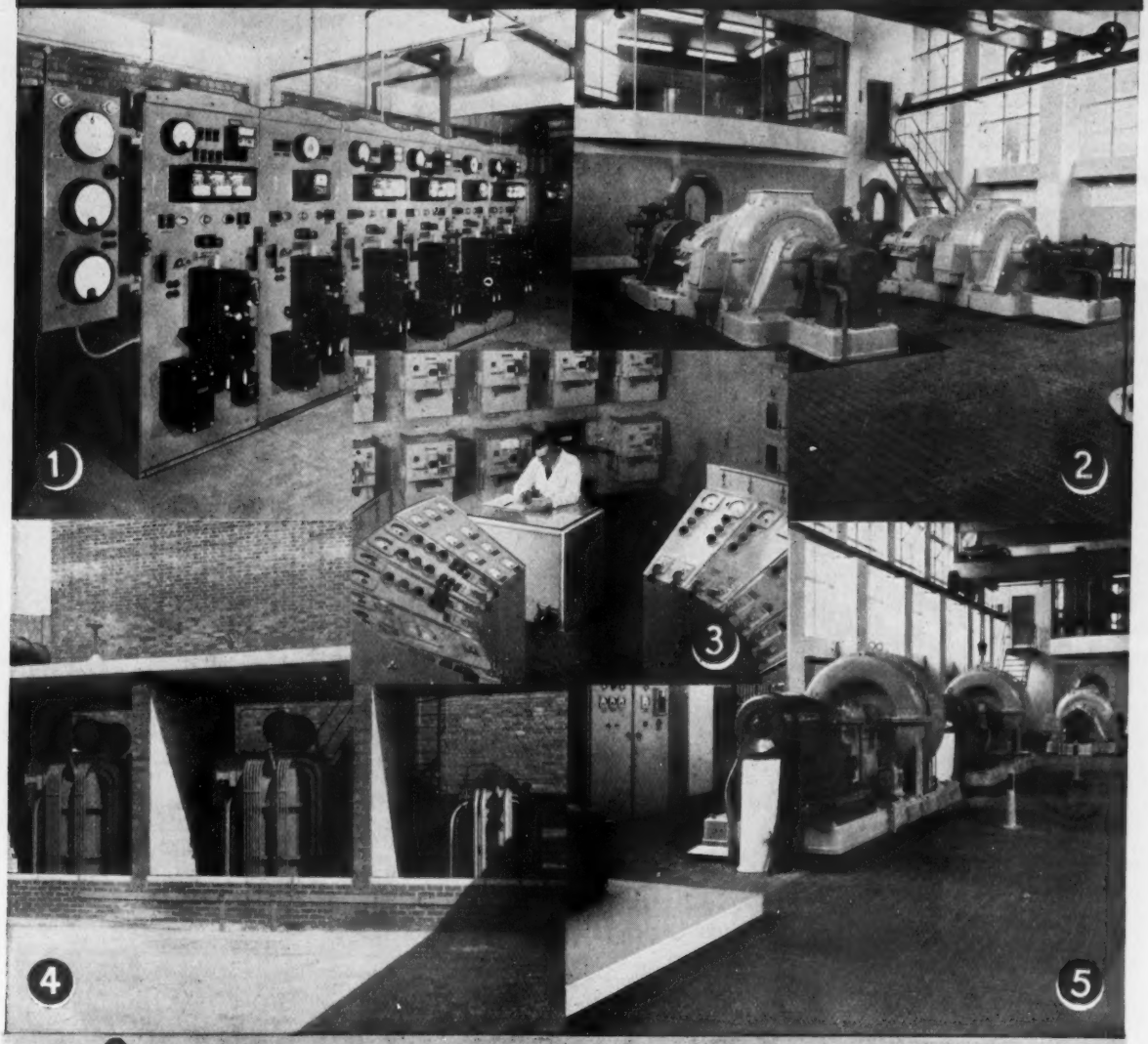

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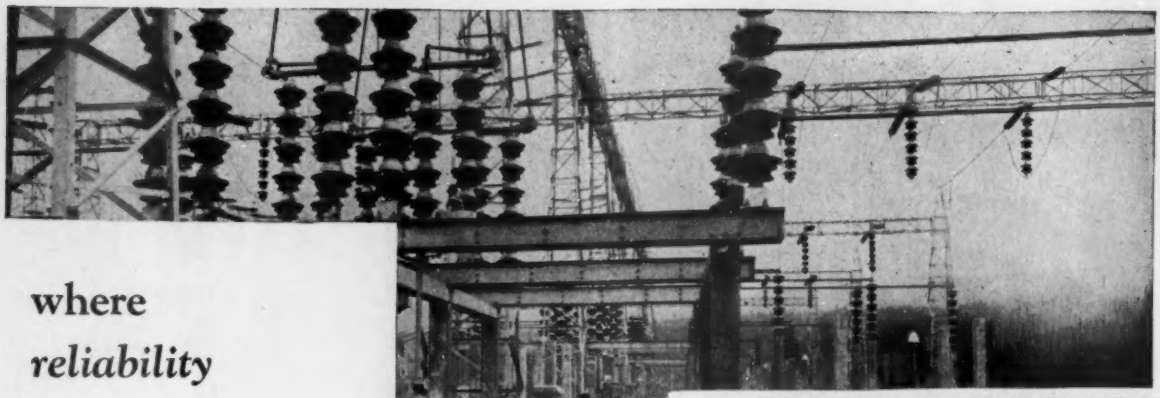

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is a
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as in the control systems for the operation and protection of high voltage transmission circuits, GENERAL CABLES are being installed with confidence, because QUALITY is the keynote throughout the wide range of their production

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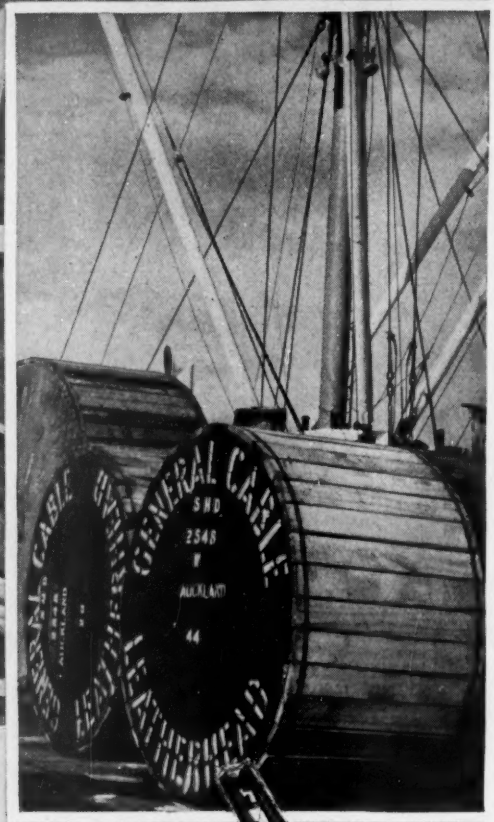

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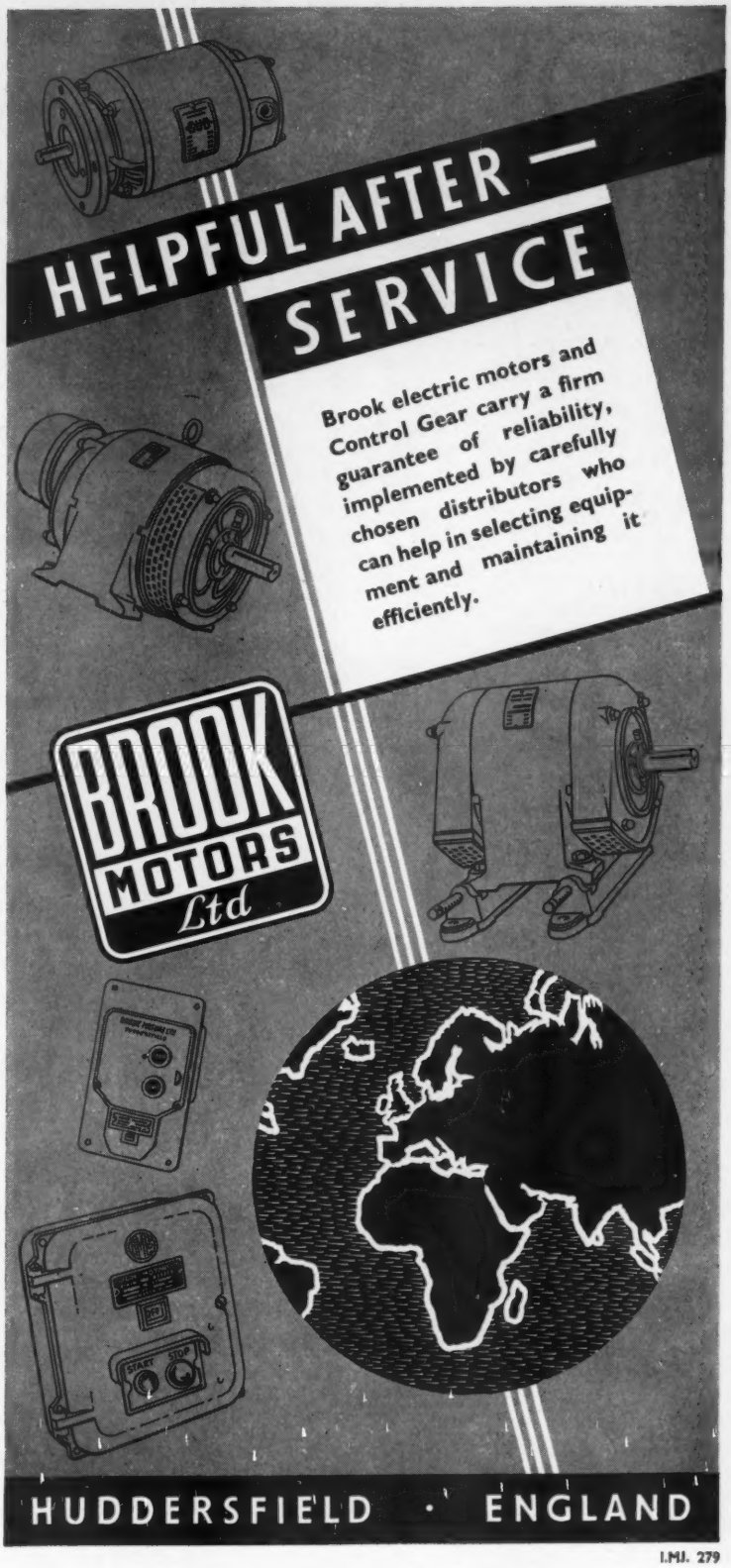
OVERSEAS REPRESENTATIVES IN SIXTY COUNTRIES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I.MJ. 279

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Highest Thermal Efficiency

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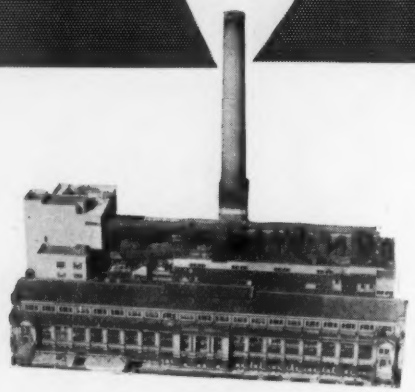
30.86%



For the second year running, it was an ICL-equipped generating station which headed the British Electricity Authority Table, with a record thermal efficiency.

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ELECTRICAL TIMES

THURSDAY, 8 JULY, 1954
Volume No. 126 Number 3270
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SET A TERM TO RESTRICTIONS

For two and a half years now, the Hire Purchase and Credit Sales Order has exerted a brake on electrical progress. Introduced at a time when inflation was an active danger and materials in somewhat embarrassingly short supply, it made an arbitrary distinction between such near necessities of modern domestic life as the cooker and the washboiler, and other apparatus that many consider of first importance. The latter included such appliances as water heaters—since removed—washing machines and refrigerators. Manufacturers of all these have felt the effect of the severe restrictions imposed on the permitted term of hire purchase: but would-be owners of such economic and labour saving devices have suffered more, and with them the electricity boards who look to the wider use of domestic appliances for the development of demand and the improvement of load factor. Surely, now that inflation has receded into the background of the economic worries of today, the time has come to modify, or better still, abandon the Order. There have been many signs within the past few months that the times are easier, notable amongst them being the further reduction in the bank rate a few weeks ago. Last week Parliament was informed that the President of the Board of Trade had the future of the Order under consideration. He should find sufficient evidence to convince him that it is time for some alleviation of the burden which it imposes. The industry should be ready at the retail level for any such move. So soon as lower initial payments and extended hire terms become permissible, there will be a surge of future spending from which it can benefit.

EFFICIENT RECTIFICATION

Rectification has received constant attention throughout the present century and the successive devices evolved by electrical engineers have steadily reduced the energy losses inherent in the conversion from alternating to direct current. The latest advance, which is described on a later page, is the introduction of germanium as a rectifier material in the power engineering field with a present efficiency of 98·5% on a 300 kW load, and with future improvements on this figure confidently predicted. As yet, the germanium heavy current rectifier must be considered unperfected, but obviously it has important possibilities. Even the contact rectifier, now being further developed in this country, and increasingly used in electro-chemical processes, does not offer so high a conversion efficiency, while in the lower range of voltage concerned, the mercury arc rectifier is left well behind. In large

scale electrochemical processes, cost of power has more significance than in most other industries, and a one per cent. improvement in efficiency can have a considerable influence on methods and plant economies. Initial cost and reliability remain factors of prime importance however, and it has to be remembered in this respect that the supply of germanium has been neither plentiful nor cheap. For the present, it would seem that the development of power applications of germanium may be slowed down by the necessary priority given to transistors and similar h.f. devices when the allocation of this scarce material is considered.

INDEPENDENT FIGURES

There is no lack of general statistics concerning the electrical industry. They come in a great flood in October with the annual reports of the B.E.A. and the area boards, and remain a substantial power throughout the year in statements and publications in bewildering variety. One thing is common however: such figures come from sources interested in electricity supply as a subject in its own right. It is interesting, then, once a year, to take note of some carefully collected statistics on the use of electricity which are assembled for quite another purpose. The Hulton Readership Survey is the source: fuel usage is merely one among many characteristics against which our preferences as readers are analysed. This year, as the extracts reproduced elsewhere in this issue show, there is evidence of the significant advance in electrification of which the industry has been talking. There were some 400,000 more families enjoying the convenience of an electricity supply in the early months of this year than in 1953; put in another way, the proportion without electricity had fallen from 10 to 8%. The result provides a confirmatory check on the reality of Lord Citrine's recent claim—over half a million consumers added during the financial year 1953 to 1954. There is interest in comparing the story the Survey has to tell about gas. A mere 20,000 increase here, not enough to affect the percentages; and a possibly significant story of modern preferences in the increase from 20 to 21% in homes "with electricity only."

THE SIMPLICITY OF EARTHING

It is proverbial that engineers always seek the simplest way of doing a job, yet with such a maxim we succeed in achieving a surprising degree of complexity. The reason is not far to seek. In general, simple methods provide simple results and the complex demands of the modern way of life must be matched by corresponding complex methods if we are to achieve the performance we require. If the digital computor replaces the abacus, it is because its superior performance is necessary for our modern problems. One of the simplest electrical practices which has survived among the growing complexities of control gear and of higher power equipment is that of solid earthing. However, for the past twenty years or so earthing has been slowly coming under suspicion. In theory it is a good deal more complex than appears in practice, nor is it universally applicable. Alternative methods have long been available but inevitably they are more costly to apply. Despite this, there is growing recognition of their merits and manufacturers appear to be giving increasing attention to this field. There are signs that more use is likely to be made in future of alternatives to solid earthing as a means of protection but as it will be a long time before we depart entirely from the simple connection to the water tap, it becomes important that the limitations of this delightfully uncomplicated method of protection should be fully understood by all who make use of it.

GLOBAL GROWTH

On a world basis, consumption of electricity has been increasing by about 9·5% per annum. That is the conclusion suggested for the years 1948-52 inclusive by the latest Statistical Year Book of the World Power Conference. Breakdown of the figures in terms of large zones tells a more interesting story. For most parts of the world, the rate of increase was within the range of 7 to 9% approximating the 8% which applies in many widely-electrified countries. Eastern Europe and the U.S.S.R., however, provide marked exceptions to this general rule. Annual expansion rates were 12·6% and 15·4% respectively, matching in with comparatively low consumptions per head of population of 570 and 580 kWh per year. The needs of Africa stand out vividly, with only 90 kWh per year per head, and an 8·2% yearly expansion. Saturation on a global basis must be reckoned far off indeed.

GEORG SIMON OHM

Georg Simon Ohm died one hundred years ago yesterday. The centenary is worthy of notice, for there is no relationship in electrical science so widely known as that bearing the name of this German physicist. For most of us, Ohm's law was an introduction to the mathematical exactness which characterises our chosen branch of technology. Yet the discovery of the fundamental relationship between current and voltage left Ohm a disappointed man. So unenthusiastic was the reception accorded to the pamphlet he published in 1827 announcing his law, that he forthwith resigned his teaching post at Cologne Gymnasium in protest. It was not until 1833 that he again accepted a teaching appointment, this time at Nuremberg, and for recognition of the importance of his discovery, he had to wait until 1841, when the Royal Society in this country awarded him the Copley medal. It was the work of the great mathematician Fourier on heat flow that gave Ohm the clue for his discovery. By its results, electrical science was placed on a sound basis in readiness for the great expansion that followed later in the century: Ohm's work combined with that of Ampere replaced vague ideas of "quantity" and "tension" by defined concepts of current strength and electro-motive force. Nor is it only electrical science that has cause to remember Ohm. He wrote widely on contemporary problems of physics, and another "law" that stands to his credit has been described as the beginning of the study of musical acoustics. But it is undoubtedly for his electrical work that he will be remembered, and in the law and resistance unit with which his name is associated, he has a sure and continuing memorial.

Meteor

Protective Current Transformers

A COMPARISON OF BRITISH AND NORTH AMERICAN PRACTICE

By A. A. HALACSY, D.Sc. A.M.I.E.E., Mem.A.I.E.E.

CURRENT transformers produced by manufacturers have to comply with standards issued by Standards Institutions and Associations, and with specifications of utility companies. While current transformers serving simple overcurrent protective gear are used in all branches of modern life and industry, high grade protective c.t.'s are required usually by utility companies only, for their sensitive and complex protective gear. The purpose of this article is to compare British and American practice in this field. Although there is no big difference, there are several points worthy of mention, especially because a new Standard Specification (B.S. 2046: 1953) was published recently.

Standard Specifications

In Britain no standard specification existed specially for protective c.t.'s and British Standards Specification No. 81 for metering c.t.'s issued in 1936 was used for that purpose until the new B.S. 2046: 1953 was issued recently for protective c.t.'s. In America, the American Standards Association's American Standard for Transformers, Regulators and Reactors includes C 57.13—1953 Instrument Transformers, C 57.23—1948 Test Code for Instrument Transformers, C 57.33—1953 Guide for loading and operation of Instrument Transformers. In Canada no standard specification exists yet for c.t.'s. The Canadian Standard Association is working on such a one, following the American line very closely. The American Standard is used now in Canada. The terminology used in Britain and in America differs but slightly and is explained in the introduction of the relevant standards.

Basic Requirements

A protective c.t. is required to (1) supply *sufficient energy* to initiate the operation of the protective gear, and (2) supply a *current in a ratio* to the primary current, which ratio must be true enough to initiate that operation at the required and no other value of the primary current.

The second requirement demands a minimum variation in errors of the individual c.t.'s supplying a protective gear which operates by comparing the values of the current, supplied by these c.t.'s.

The British and American Specifications seem to differ in many points. A closer examination reveals, however, that they are but different forms of expression of these two requirements.

The British e.g. specify a *"rated burden"* in VA at the rated (usually 5 amps) secondary current. The c.t. is required to push its secondary current through a burden (having the same inductance and resistance within the whole specified current range) without exceeding the specified *ratio error* and without drawing more *exciting current* than specified. The sequence is reversed in the American standard, specifying the *ratio errors* which must not be exceeded and the *secondary terminal voltages*, which must be maintained when the specified *burden* is supplied by the c.t. within a specified current range.

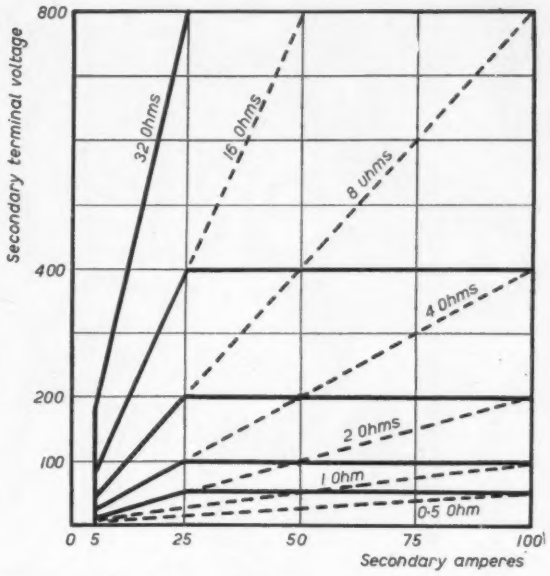


Fig. 1. Burdens and voltages at overloads standardised in America. Solid lines are Class H, dotted lines Class L (Based on A.S.A. C57·13)

Currents and Voltages

The American Standard specifies a single current range of 1 to 20 times rated *secondary* current. This is equivalent to 5 to 100 amps, 5 amps being taken as rated secondary current. The British specify four different *primary* current ranges, viz., from 1 up to 5, 10, 15 and 20 times rated primary current, and recommend 10 for general purposes. These multipliers are called—

$$\text{rated saturation factor} = \frac{\text{rated primary saturation current}}{\text{rated primary current}}$$

The value of the current derived from the rated current multiplied by the saturation factor is called rated saturation current. In America the expression "saturation" is not used, and is considered to have a doubtful meaning.

The British specify generally 5 amps as full load secondary current but allow 1 or 0·5 amps too "under certain conditions." The A.S.A. specifies 5 amps only; it acknowledges, however, the possible existence of other non-standard current ratings and advises in a note to C-57-13·030 (b) on the performance of such non-standard c.t.'s.

The British specify the burden still in the somewhat confusing VA rating. The confusion is dispelled by stating that the VA rating is to be understood at the rated secondary current (usually 5 amps) and at a power factor of 0·7 lagging. This same inductance and resistance is considered through the whole current range.

The British rated burdens are 2·5; 5; 7·5; 15; and 30 VA at a secondary "rated current" of 5 amps, resulting in

0·1; 0·2; 0·3; 0·6; and 1·2 ohms respectively. The recommended maximum is 15 VA for general purposes.

These burdens are much lower than the ones standardised in America. A.S.A. specifies the secondary terminal voltages at 20 times rated secondary, that is 100 amps current, as 10; 20; 50; 100; 200; 400 and 800 V resulting in 0·1; 0·2; 0·5; 1; 2; 4 and 8 ohms or 2·5; 5; 12·5; 25; 50; 100 and 200 VA at 5 amps.

Most of the c.t.'s produced are 50, 100 or 200 V types (12·5, 25 or 50 VA at 5 amps). Still higher burdens (even 16 and 32 ohms) are standardised for high internal impedance c.t.'s.

Errors and Exciting Current

The standardised ratio errors are ±2½% and ±10% in America. ±5% is discussed but probably will not be included in the future Canadian Standard Specification. In Britain the ratio errors specified are ±3%; ±5% and ±7·5% at rated Primary Current; and ±3%; ±10% and ±10% above rated Primary Current.

The British specify 3%, 10% and 15% as the maximum values of the exciting current expressed as a percentage of the rated secondary saturation current, measured at rated secondary saturation e.m.f., resulting in phase angle errors of 2°, 6° and 9° respectively. It is confessed, however, that "experience indicates that these maximum values are rarely approached in practice." For that reason phase-angle errors are not specified at all in America.

The figures of errors must be handled with some precaution in a comparison. The American Standard Specification uses the Ratio Correction Factor (R.C.F.) generally for all current transformers. In the case of Protective c.t.'s (C-57.13032 (a)) a "per cent ratio error" is defined too as $e_A = 100$ (R.C.F.-1). This American "per cent ratio error" has a sign opposite to the British; this is a point where one has to be careful.

A.S.A. C-57-23.200 (b) defines the Ratio Correction Factor as fellows:

$$\text{R.C.F.} = \frac{\text{True Ratio}}{\text{Marked Ratio}} = \frac{I_p/I_s}{K_n} = I_p/K_nI_s$$

where I_p = actual primary current; I_s = actual secondary current; K = nominal (marked) ratio.

The British Standard defines the percentage ratio error as

$$e_B\,\% = 100\ (K_nI_s/I_p\text{-}1)$$

The first member in the parentheses is the reciprocal value of the American R.C.F.

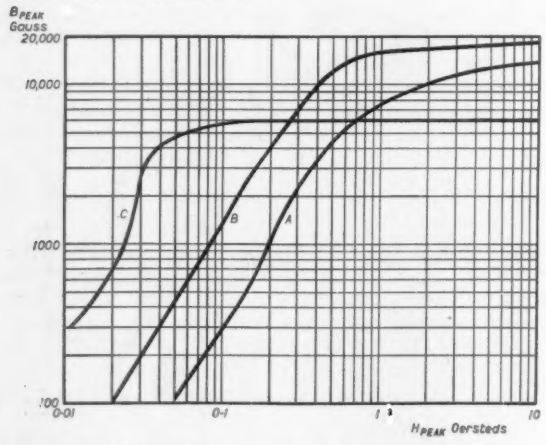


Fig. 2. Typical magnetising curves for c.t. materials. A; hot rolled silicon steel (U.S.S. Transformer 52, close to Ferrosil 80). B; grain oriented silicon steel (Armco Trancor 3X, close to Alphasil 44). and finally, C; Mumetal

Thus it follows that

$$e_B\,\% = 100\left(\frac{1}{\text{RCF}} - 1\right)$$

Comparing this British ratio error e_B with the American ratio error $e_A = 100$ (R.C.F.-1) we have the situation given in Table I.

Table I.—British and American Error Limits

British	e_B %	(+)	0	(−)
American	R.C.F.	< 1	1	> 1
	e_A %	(−)	0	(+)

Uniformity of C.T.'s

Neither the British nor the American Standard specifies the uniformity of protective c.t.'s whereas this is a vital requirement in the case of protective gears operating by comparing the currents of those c.t.'s. The A.S.A. C-57-13.033 (b) (2) specifies only that typical excitation curves between exciting current and exciting voltage of

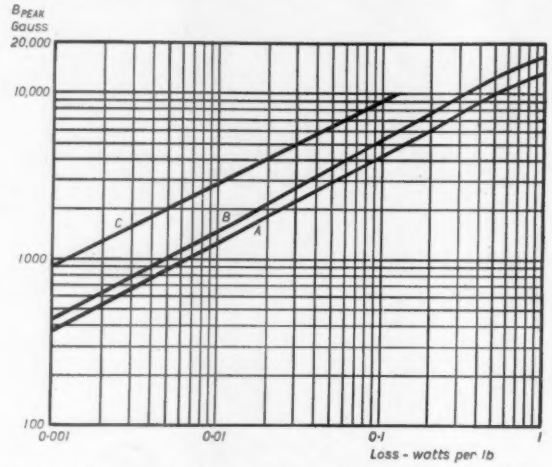


Fig. 3. Typical watt-loss curves for c.t. materials. The letters indicate the same materials as in Fig. 2

bushing type c.t.'s only shall be made available upon request and the maximum expected deviation from the values shown shall be indicated. In order to escape troubles, customers have to specify this deviation and the usual figure is maximum ±10% of the voltage at the same current in Britain and in America.

Internal Reactance

The influence of the internal reactance of a c.t. on its performance is well recognised on both sides of the Atlantic. A low internal secondary impedance has no major influence on the voltage drop and output of the c.t.

In the case of a high internal secondary impedance matters are otherwise. The internal voltage drop across this high impedance increases more rapidly than the induced secondary voltage and such a c.t. is not able to increase its terminal voltage in ratio with the current.

The A.S.A. drew a limit between low and high impedance c.t.'s by establishing two classes, L and H, of protective c.t.'s accordingly. No restriction relates to the burden in the L-Class (all bushing transformers are considered to be L-Class) whereas the H-Class c.t.'s are those which are able to carry their specified burden impedance up to only 5 times rated secondary current without exceeding the permitted errors. At higher currents these H-Class trans-

formers are requested only to maintain the standard secondary terminal voltage (10, 20, 50, 100, 200, 400 or 800 V), but the burden can be reduced as necessary to fulfil the requirements set regarding the errors. Fig. 1 shows the relevant performance curves. It has to be mentioned that some public utilities are not willing to accept H-Class.

The British do not make any allowances regarding the performance of c.t.'s in the high impedance class. They set a limit, again arbitrarily, and classify the internal reactance as "high" if the ratio error $e_p\%$, measured at the rated primary saturation current I_p at rated burden is more than 20% higher than if calculated from the exciting current I_o at rated secondary saturation e.m.f., in a formula

$$e_p\ \% \geq \left(1{\cdot}2\ I_o\ K_t/I_p\right)\ 100$$

were K_t = ratio of secondary turns to primary turns.

The British distinction concludes in setting up different methods for testing the ratio error; but it does not reflect on the performance-specification of the c.t.'s.

Magnetic Circuit

The above requirements reflect the possibilities offered by the ferro-magnetic materials used to build up the magnetic circuit. The satisfactory fulfilment of those requirements depends on the proper application of such materials.

The materials used can be divided into three classes: 1, hot rolled Silicon steels; 2, grain oriented Silicon steels; 3, nickel-steel (Figs. 2 and 3). All three classes are known on both sides of the Atlantic. The peculiar situation is, however, that Americans are making greater use of the grain oriented Silicon steels than the British, while Mumetal being very popular in Britain is used only by one or two manufacturers (e.g. Sangamo and Superior) in America.

This situation has not much bearing on protective c.t.'s, but still it seems to be significant enough to mention. It is due primarily to the availability of materials.

Two other differences exist in the building up of the magnetic circuit. Composite cores are often used in Britain; seldom in America. The reason may be that such a combination is especially advantageous when taking Mumetal as one of the components; and nickel-steel is hardly available nowadays in America. Another reason may be that composite cores are required mostly in a c.t. for the combined purpose of metering and protection, which was usual in some places in Britain and was perhaps due to the absence of a special British Standard Specification for protective c.t.'s.

The second difference is that American manufacturers developed and perfected to a high grade the so called "C" cores, which are not too well known and not used yet for c.t.'s in Britain. These are wound of steel strip to a quadratical shape, annealed, clamped and cut to two C-shaped halves. The coils are wound on these halves which are reunited thereafter in order to close the magnetic circuit. The advantages of both the ring core and the wound coil can be utilised by this method.

TABLE II.—STANDARD PRIMARY CURRENTS OF CURRENT TRANSFORMERS

B.S.S. 81	A.S.A. C-57·13		
	Single Ratio	Double Ratio	Multi-Ratio (Bushing Type)
5	—	—	—
10	10	—	—
15	15	—	—
20	—	—	—
—	25	25/50	—
30	—	—	—
40	40	—	—
50	50	50/100	—
60	—	—	—
75	75	—	—
100	100	100/200	—
150	150	—	—
200	200	200/400	—
300	300	—	—
400	400	400/800	—
500	—	—	—
600	600	600/1200	600/400/300/200/100
800	800	—	—
1000	—	—	—
1200	1200	—	1200/800/600/400/200
1500	1500	—	—
2000	2000	—	2000/1500/1200/800
3000	3000	—	3000/2000/1500
4000	4000	—	4000/3000/2000
5000	—	—	—
6000	—	—	—

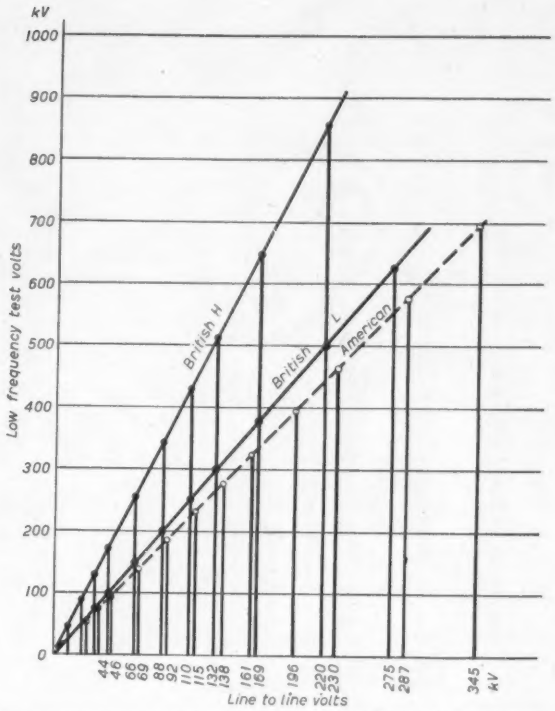


Fig. 4. Low frequency test voltages standardised for c.t.'s operating on line to line voltages higher than 15 kV

Ratios

The ratios are standardised and used not so much according to the actual requirements of the customers but rather according to the rating of the respective section of the switchgear and according to the practical testing facilities offered by the test equipment. The testing laboratories compare the c.t.'s to be tested with their own master standard c.t.'s. These master standard c.t.'s are by necessity multi-ratio c.t.'s and it follows that the ratios are interdependent and cannot be chosen at will. The standard ratios are shown in Table II.

Thermal Limits

Thermal limits are set by the material used for insulation. The tremendous expansion in plastics and the advent of silicones practically has upset the ideas and outdated all standard specifications relating to the classification of the insulating materials and temperature limits and the situation is all but not settled today in America. Investigations carried through during the recent years contributed much

to the knowledge about insulating materials especially in the Classes B and H. Class B materials are non-organic with some organic binder. Class H are the silicones. The concept of "lifetime of insulation" gained acceptance.

It is more and more recognised that not only the physical properties of the material but its environment and application too, are important, and should be taken into consideration, and this certainly does not simplify the situation. Revision of the relevant sections of the standard specifications is definitely ahead. This work is well advanced in America and a marked temperature increase is expected.

The ambient temperature of the cooling air is taken as not exceeding 40° C (B.S.S. 81, Appendix A) in Britain, not exceeding 40° C and 65° C in America (A.S.A. 57-13005, 57-13040 and 57-33.020). The British standardised 35° C whereas the American 30° C and 55° C, as the 24-hour *average* temperature of the cooling air.

The differences in the average temperature and the difference in the allowed temperature-rise cancels out in most cases, as shown in Table III.

No provision exists for Class H insulation in Britain at the present time, probably because silicones are generally less available. Oil-immersed Class A is allowed to have a temperature 10° higher in Britain than in America. Compound-filled c.t.'s can have the same temperature rise in Britain and in America. This is 10° C less than for British oil-filled c.t.'s.

Secondary Conductor

All the above-mentioned temperatures are those of the copper under continuous operational conditions. It sets a lower limit to the cross sectional area of the secondary conductor rather than to the primary, the latter being governed mostly by short-circuit considerations.

The smallest size of the secondary is very often specified by big customers, as e.g. public utilities, and is about the same; 15 s.w.g., 0·004072 sq in. in Britain is practically the same as 13 a.w.g., 0·004067 sq in. in America, for the usual 5 amp secondary. 0·0024 sq in. (17 s.w.g.) is specified for a 10 amp test winding in the new British specification. Such test windings are rather popular with some British customers, but not so in America.

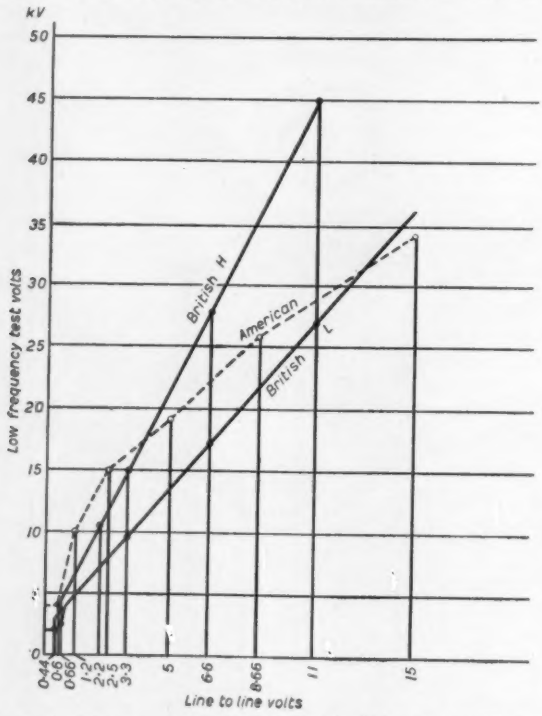


Fig. 5. Low frequency test voltages standardised for c.t.'s operating on line to line voltages lower than 15 kV

Short-Circuit Rating: Primary Conductor

While the size of the secondary conductor is critical under normal operational conditions, the size of the primary conductor is critical under short-circuit conditions, when the secondary current is limited by saturation.

The British Standard allows only 200° C rise, i.e. 240° C total *"in any part* of the transformer" under over-current, i.e., short-circuit conditions, while the A.S.A. specification allows 250° total in case of Class A insulation and 350° C total with Class B insulation, *in the primary copper.*

The Americans are using formulae for checking the maximum temperature. The British tabulate the permissible current densities. Those tabulated current densities satisfy the American formula for Class A insulation if the eddy current losses are taken as about 10% of the watt losses in the copper. This 10% is a fairly average figure and so the British and American requirements can be said to agree in case of Class A insulation. The British Standard does not distinguish between insulation classes in this respect, which is not surprising if one considers that the old British Standard was published as long ago as 1936, and the newly published Standard relates to protective c.t.'s only, and obviously had to fall in line with the old and unchanged standard for metering c.t.'s.

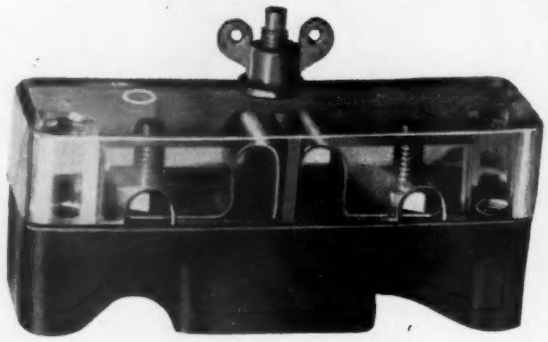


Fig. 6. Short-circuiter latch of type used on American c.t.'s

Somewhat related with the thermal over-current rating is the mechanical over-current rating or, in American terminology, the mechanical short-time current rating (B.S.S. 81, § 18 (e), and A.S.A.-C57. 13·046, 22·105, 23·220).

Some difference is in the magnitude of the current specified for the test of the mechanical performance. Both standards specify the initial peak value of that current, but the Americans are using a peak factor $2 \times \sqrt{2} = 2{\cdot}82$, the British $1{\cdot}8 \times \sqrt{2} = 2{\cdot}5$ to arrive at that peak-value from the same r.m.s. value. The mechanical rating, however, can be specified different from the thermal rating in America, while in Britain the c.t. must withstand the mechanical effects of the rated thermal over-current.

The secondary should be shorted in America, whereas connected to the rated burden in Britain during an over-current test. This makes practically no difference.

Primary Coil Insulation

The B.S. specifies a test voltage for c.t.'s used in three- and single-phase systems one line terminal of which is permanently earthed (system symbol H); about three times higher than for neutral-earthed or normal insulated systems (system symbol L). No such distinction is made in the A.S.A. specification. A.S.A. allows the use of c.t.'s of

considerably reduced insulation class at the neutral of Y connected apparatus one primary-terminal connected directly to ground. The British and American test voltages are shown in Table IV and in Figs. 4 and 5.

The difference between the British and American specification does not require a different design in most cases, by two reasons.

1. Practically all the systems are either neutral-point earthed or normally insulated from 22 kV upwards. The

TABLE III.—ALLOWED COPPER TEMPERATURE IN °C.

Insulation		British	American	
			Present	Expected in future
A	Compound	85	85	85
	Oil	95		
B		110	110	140
H		—	170	210
		—	+ 10° C allowed for the maximum temperature	

The allowed copper temperature is the sum of the average ambient temperature and the copper temperature rise as indicated by resistance.

test voltages specified in Britain and in America for the nearby L system voltages do not differ much for systems from 22 kV to 138 kV. Still, while a c.t. built for the British L system 22, 33, 44, 66, 88, 110, 131 kV will satisfy the American 25, 34·5, 46, 69, 92, 115, 138 kV respectively insulation class, this is not true in reverse.

2. Below 15 kV c.t.'s built for the British 11L or 6·6H, 5·5H, 3·3H, 2·2H kV will satisfy the American 8·7, 5, 2·5, 1·2 kV insulation class, and c.t.'s built for the American 15, 8·7, 5, 2·5, 1·2 kV class will satisfy the British 11L, 6·6L, 6·6L, 5·5L, 3·3L or 6·6H, 5·5H, 3·3H, 3·3H nearly 2·2H.

A considerable discrepancy exists around 15 kV. The test voltages for the American 15 kV class will satisfy only the British 11L and 6·6H systems, while a British 22L or 11H c.t. is wanted to satisfy the American 15 kV class.

A difference exists in the lowest voltage range, i.e. below 2,200 V too. The lowest voltage class specified in America, is 600 V for c.t.'s. The 4,000 V test voltage for that class satisfies all British requirements up to 660 V Class H and L. On the other hand no British c.t. made for up to 660H satisfies the American standard at all. The British 660H is not much below but still a 2·2H or 3·3L is wanted to satisfy the American 600 V class.

Comparing test voltages we must not forget a very important difference. The A.S.A. specifies an *impulse test* (C.57 paragraphs 13.053, 11.035, 13.016, 13.051) using a 1·5 x 40 micro-second voltage wave, while the B.S.S. does not specify such a test at all.

2,000 V test voltage is specified in the B.S.S. 81, § 7a, for the secondary and between sections of secondary and primary windings.

Turn to Turn Insulation

The A.S.A. Specification C.57, 11.037, 13.055a, asks for induced high voltage test of the secondary winding in order to test the interturn insulation. The British does not, except in the case of voltage transformers.

A.S.A. limits that test for 3,500 V between the secondary terminals, that voltage being the maximum allowed there. This is a one-minute value. It may be of interest to mention that considerably higher voltages have been mentioned in a paper published recently.*

The A.S.A. C.57, 13.047 also demands that the operation

* *Proceedings of the I.E.E. Part II, June 1953.*

TABLE IV.—BRITISH AND AMERICAN TEST VOLTAGES

Line to Line Voltage V		Standard Low Frequency Dielectric Test Voltage			
British	American	British System L	American A.S.A.	British System H	Canadian C.22·2 for Switch-gear
440	—	2000	—	2000	—
—	600	—	4000	—	—
660	—	1000 + 2·25 V = 2500	—	3600	3200
—	1200	2000 + 2·75 V =4700	10000	6700	—
2200	—	6950	—	10580	—
—	2500	7625	15000	11800	8000
3300	—	9500	—	15000	—
—	5000	13200	19000	21500	14000
5500	—	14375	—	23500	—
6600	—	17000	—	28000	—
7500	—	—	—	—	19000
—	8700	21600	26000	35800	—
11000	—	27000	—	45000	—
—	15000	36000	34000	61000	36000
22000	—	52000	—	88000	—
—	25000	58000	50000	100000	—

of current transformers should be guarded against to prevent excessive voltages in the secondary winding if open circuited.

It is common practice in America to have a short-circuiter latch between the secondary terminals. (Fig. 6.)

In Britain again many manufacturers use a grounded metal layer between secondary and primary as an ultimate protection against an appearing of primary voltage in secondary. Such a precaution is rare in America, but for bushing type c.t.'s.

Insulating Materials

The technique of the insulation of a c.t. depends on the materials used and has a decisive influence on the design of a c.t. The method of insulation was well established and accepted for a long time. Some kind of braiding (usually cotton) was used for insulating the secondary wires, and some kind of tape (usually varnished cloth) was used for insulating the primary coil.

Fig. 7. New type indoor-outdoor transformer moulded in thermo-setting resin which serves as insulation, support and casing. Only the secondary terminal studs, and the base mounting studs project through the plastic casing

The undreamed development of the plastic materials, to which reference was already made above, brought already considerable changes in the insulation of c.t.'s and we are certainly only at the threshold of greater changes.

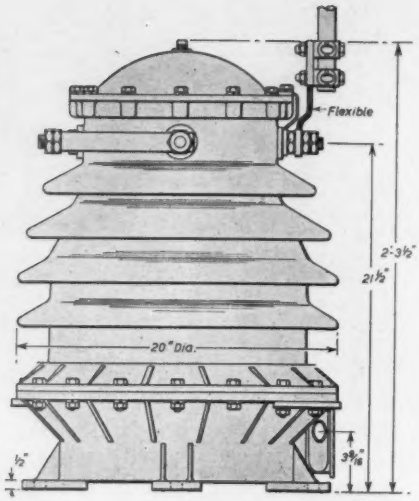


Fig. 8. 34·5 kV "Beehive" oil insulated c.t. This has a porcelain cover

Wires became available with synthetic resin insulation as Formex wire (polyvinyl-acetal) in America and as Lumex in Britain, many years ago improving the space factor by at least 10% in c.t.'s.

A butyl-moulded c.t. was produced by the American General Electric Co. as early as in 1949, and in 1953 the first Window Type c.t.'s insulated by epoxy-type casting resins made their appearance at the American market. (Fig. 7.) The non-taped, moulded or cast insulation of c.t.'s certainly will spread rapidly and will cause big changes in c.t. design in the near future. The changes are expected first in the voltage ranges below 15 kV and they will affect the higher voltage ranges too, but later. For the time being it is a fairly general practice to use oil as the main insulating medium above 11 kV in Britain and above 15 kV in America. A few firms are making oil-less c.t.'s up to 25 kV in America. The model illustrated in Fig. 7 is by Allis-Chalmers.

Ring type or bushing type c.t.'s are used direct on the bushings of the circuit-breakers wherever possible in higher voltage class switchgear too, and only in cases where this arrangement is not practical, are used separate post-type c.t.'s as e.g. in connection with some air-blast or small oil content circuit-breakers.

The post type c.t.'s require a considerable quantity of oil and an American manufacturer (General Electric) reduced this quantity and raised the short-circuit strength by filling the c.t. chamber with quartz-sand, recently. The general trend is to reduce the size of the c.t.'s.

Appearance

The same voltages, viz. 11 kV in Britain and 15 kV and 25 kV in America, are the marks above which the c.t.'s are produced as outdoor c.t.'s only. The lower voltage c.t.'s are indoor as well as outdoor types. The new plastic insulated c.t.'s referred to above are made the same for indoor and for outdoor use.

The vast majority of the c.t.'s are indoor type and made for the lower voltages. Very few American firms are producing c.t.'s for voltages higher than 25 kV (e.g. General Electric, Westinghouse, Allis-Chalmers, Standard in U.S.A. and in addition, Eastern Power Devices Ltd. in Canada. (Fig. 8).) The sources are reduced to General Electric and Westinghouse above 69 kV.

The lower voltage c.t.'s (below 11 or 25 kV) are built in the conventional forms. The same arrangement of core, coil and clamping can be found in Britain and in America. A great emphasis is laid on the interchangeability of such c.t.'s in America, therefore, the position and size of holes drilled in the supports and in the primary conductors are getting more and more standardised.

WORLD STATISTICS OF ELECTRIC POWER

IN the years 1948 to 1952 world production of electricity increased at the high average annual rate of 9·5%, reaching in 1952 a level of 1·14 million million kWh (excluding the mainland of China), according to the Seventh Statistical Year Book of the World Power Conference, published last week. The annual progress is most spectacular in the U.S.S.R., where the annual rate of increase is as high as 15·4%, whilst "Eastern Europe" (the "Iron Curtain" countries) falls into second place with a rise of 12·6% each year in electricity production. Of the other geographical areas, "Western Europe" has been increasing its production by 9·5%, annually, North America by 8·4% and Asia (excluding the U.S.S.R. and Chinese mainland) by 9·9%—the third highest.

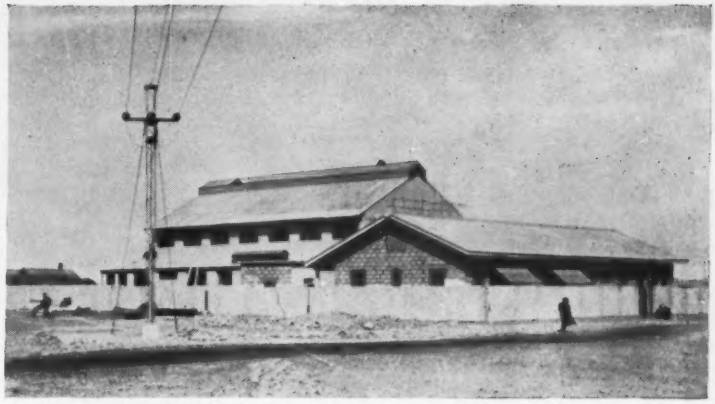
World Production of Electricity 1948—52

Area	Actual Production kWh × 10⁹					% of total 1952	Annual rate of increase 1948–1952	Production /head of Population kWh × 10⁹ 1952
	1948	1949	1950	1951	1952			
Africa ...	13·2	14·0	15·5	16·8	18·1	1·6	8·2	0·09
North America	391·2	403·6	451·6	504·7	539·7	47·4	8·4	2·36
South America	16·0	17·1	18·2	19·9	21·2	1·9	7·3	0·18
Asia[2] ...	45·1	51·4	56·0	60·5	65·8	5·8	9·9	0·08
"Western Europe"[3]	213·9	228·4	256·7	289·7	307·1	27·0	9·5	1·02
Oceania ...	11·8	12·7	13·3	14·6	15·6	1·4	7·2	1·15
"Western World"	691·2	737·2	811·3	906·2	967·5	84·9[5]	8·8	0·57
"Other Europe"[3]	34·1	38·6	43·5	48·7	54·9	4·8	12·6	0·57
U.S.S.R....	66·0	78·0	90·3	103·0	117·0	10·3	15·4	0·58
World[4] ...	791·3	843·8	945·1	1,057·9	1,139·4	100·0	9·5	0·57

1, Europe other than Bulgaria, Czechoslovakia, East Germany and Berlin, Hungary, Poland, Roumania and the U.S.S.R. Production in Northern Ireland was not yet reported. 2, Bulgaria, Czechoslovakia, East Germany and Berlin, Hungary, Poland and Roumania, not including the U.S.S.R. in Europe. 3, Excluding the U.S.S.R. and the mainland of China. 4, Excluding the mainland of China. 5, Differs slightly from the sum of percentage above, due to "errors of rounding."

As in previous years, this seventh Year Book is edited by F. Brown, B.SC.(ECON.)F.S.S. and published on behalf of the Central Office, World Power Conference by Lund Humphries and Co., Ltd., London. Details of electricity production given in it relate largely to the years 1950 and 1951, although considerable data for 1952 is also given together with those available for 1953. Production in 1951 totalled 1,058 thousand million kWh (excluding the Chinese mainland), of which 906·6 thousand million units were produced in the "Western World". Of this "Western" total, 859·6 thousand million is distinguished into production by fuel-operated and by hydro-electric plants. Water power contributed 40% in 334·1 thousand million kWh and fuel-operated plants 60% in 515·5 thousand million units. North America's contribution to this production totalled 495·3 thousand million units (334·9 thousand million by fuel operated plants), whilst that of Western Europe amounted to 274·0 thousand million kWh, 147·9 thousand million of which came from fuel-operated stations.

Electricity Comes to Doha



DEMAND EXPANDS RAPIDLY IN STATE OF QATAR, ARABIA

AMONGST the amenities brought to Doha, capital of the State of Qatar, by the oilfield development now taking place has been a public supply of electricity. A diesel power station with an installed capacity of 1,160 kW was recently opened by the Ruler of the State, and already the demand for power by the 15,000 inhabitants of the capital is demanding urgent work on extensions.

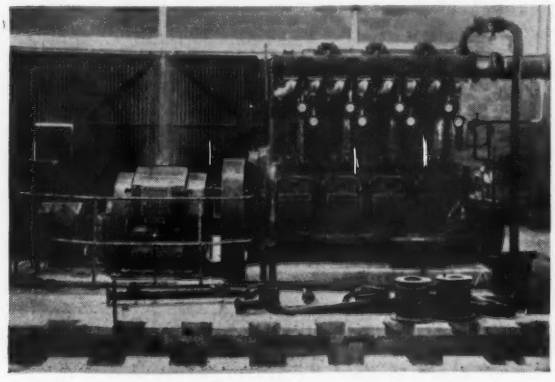
Main contractors for the complete station are Brush Export Ltd. and much of the equipment has been supplied by the Brush group. The four generating sets installed are all driven by National normally aspirated diesel engines, two being rated at 190 kW and the others at 380 kW. Generation is at 3·3 kV, to give a three-phase 50 c/s supply.

Switching and Distribution

Switching is carried out at generator voltage on a 13 panel switchboard into which are brought the ring main feeders that supply the town's network. The system is operated earthed, and to ensure that two alternator neutrals are not connected to earth at any given time, a cascade system of earthing the sets has been adopted.

The e.h.t. and l.t. distribution system has been carried out under a separate contract by British Insulated Callender's Cables Co. There are three main substations in which 100 kVA transformers step down to 415 V.

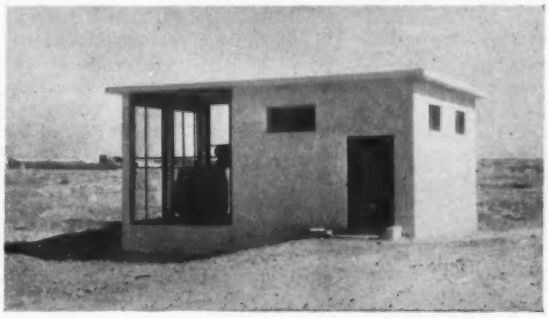
Within the station, supplies are obtained from two 100 kVA transformers (Brush) stepping down to 415 V, four-wire. The transformers feed a nine-panel switchboard which has five oil circuit-breakers and four fuse-switch units. Main cabling is carried out in p.i.l.c.s.w.a. M.I.C.C. cable is used for power and lighting circuits.



A side view of one of the 190 kW diesel-alternator sets

Special attention has been given to lighting in the main engine room. Tungsten dispersive fittings are employed, and they are designed to give an average intensity of 15 to 20 ft candles. This high value is adopted because the switchgear is sited in the engine room, and maintenance may be irregular. In other parts of the station the level adopted is 8/10 ft candles.

The area in which the power station is situated is not a good one from the point of view of water supply. For this reason forced draft type air-cooled heat interchangers have been installed, and use is made of distilled water in a closed cycle. A small distillation plant has been installed to supply the small quantity of make-up water required. A system of interconnection has been adopted for the engine jacket cooling circuits, so that it is possible to run any engine with any heat interchanger.



This close up of one substation gives some idea of the terrain

The need for some expansion of the scheme described became apparent in the middle of 1953. New equipment now arriving for the extension of the power station includes three National eight cylinder pressure charged diesel engines driving 540 kW Brush alternators. Fuel storage facilities are being increased by the installation of two 12,500 gallon storage tanks.

Consulting engineers for the complete electrification of Doha are Messrs Preece, Cardew and Rider. The State engineer concerned is Mr H. T. Hale, while the Electrical Engineer and Manager of the Qatar State Electricity Department is Mr B. L. Burgess.

Further Expansion in Tasmania

IN Tasmania, 64·4% of domestic consumers use electricity for cooking and 48·6% have electric water heaters. Obviously these impressive figures have been achieved partly because of the comparatively low cost of power supplied by the Hydro-Electric Commission of Tasmania. Yet although electricity charges were raised by about 30% in February 1953, to meet the increasing expenses, the average consumption by residential consumers since that date has jumped by a further 11%. The annual report of the Commission for the year ending 30th June 1953, which gives this information, also shows that at that date there were 49,115 electric cookers in service in the state along with 35,046 electric hot water services. During the year covered by the report there had been an increase of 6,457 electric cookers and 5,609 water heaters.

Average consumption per consumer during the year was 4,831 units, at an average cost per unit of 1·1177d. but it must be remembered that the Commission also supplies to many industries. The total number of consumers connected at 30th June 1953, was 93,107, an increase of 5,588 over the figure a year earlier. The work of providing electricity to new consumers involved the erection of 4,856 poles, 204 miles h.t. line and 195 miles of l.t. line during the year.

Some easement of the electricity rationing regulations in respect of shop window and sign lighting, contributed to an increase of 14·8% in the number of units sold during the twelve months—a total of 439·9 millions, and as a result there was a net profit of £144,679 for the period compared with a loss of £88,505 resulting from operations in the previous year.

Work is now being pushed ahead on the Trevallyn power scheme, but the French contractors for the excavation of the tunnels claim that the expenditure incurred by them was substantially in excess of that contemplated by the contract. They have asked the Commission to meet the additional costs, and the claim is being investigated. The report records that concreting is well advanced on the dam for this power scheme, and also on the foundations and substructure of the power station.

For the proposed hydro-electric development in the Wayatinah area, after further investigation of estimated cost and time of construction, the plan has been modified to include two power stations, "A" and "B." Under this modification, which has been approved by Parliament, much less tunnelling will be involved in diverting water to the "B" station which could thus be brought into operation some years in advance of the completion of the whole development.

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Convention and Consumer

RECENTLY I attended my first Supply Industry Conference because prior to Vesting Day I stayed away deliberately, and since I have not been invited. It was a pleasant and informative experience, the papers had been carefully prepared and were well presented but . . .

As I understand it, the Supply Industry derives almost its whole income from sales to consumers, yet which of the papers had any direct bearing on, or appeal to, the consumer? Possibly Mr Jones on lighting (but here again there was no lead as to how anyone could get advice on the subject) and Mr Bellamy also referred to sales of cookers and water heaters.

There was not a whole paper or session directed to the increase of sales of energy to the consumer and this prompted me to ask the forum "whether the consumer is the forgotten man" but effectively they did not deal with it. After all by now most of us know what we think is good for the consumer, but I often wonder whether the consumer knows—or cares?

Alan N. East, C.B.E., M.I.E.E.,
ABBOTS LANGLEY, HERTS.

Looping Neutrals at Switches

I READ with interest Megohm's experience of an electrical installation in Sussex mentioned in Notes on Wiring, ELECTRICAL TIMES 22 April 1954, regarding the looping of neutrals of the lighting circuit at the switches. This is a common practice in Australia, tumbler switches can be obtained with an extra terminal to accommodate the looping of the neutrals. I should also like to say I am not too much in favour of this practice as I have seen a 10 amp tumbler switch breaking a load of just under 10 amp flashing across from the live terminal to neutral and almost burning the switch out. I must state that these 10 amp tumbler switches are only the same size as our B.S. 5 amp tumbler switches so there is not much space between the live terminal and the neutral terminal so one can see how easy it is for a flashover to occur; and of course most of these switches, being used at the present time are not as robust as our British manufacture, that applies to most electrical equipment manufactured out in Australia. They seem to have quite a lot of strange ideas out here, some good, others are just a nightmare to us electricians from Britain.

Arthur Dearden,
QUEENSLAND, AUSTRALIA.

Cable Breakdown

A STATEMENT was submitted in your issue dated 20 May (Industrial Maintenance Special Section) relating to the breakdown of m.i. cables when operating in conjunction with a three-phase motor controlled by a star-delta starter. The contributor assumed that the failure was due to high voltage induced by the under-voltage coil in which case the breakdown could presumably only occur when the starter was switched from the "delta" to the "off" position as the coil is usually only energised when the starter is in the running position. It would be interesting to know whether any actual voltage readings were taken in confirmation of this assumption and also the subsequent experience with the suppressor connected across the coil.

The writer had a similar case where m.i. cables were breaking down and after a prolonged investigation it was discovered that when switching off, the under-voltage coil momentarily completed a circuit between two of the motor windings in such a manner as to produce 1·73 times the line voltage ($\sqrt{3} \times 400$) between the conductors which resulted in a breakdown. In this case the position was aggravated by p.f.c. capacitors connected across the motor windings which would delay the collapse of flux on shutting down. The trouble was completely eliminated by modifying the arrangement of the starter auxiliary switches to prevent the "star" connection when switching off.

S. McCracken, M.I.E.E.,
JOHANNESBURG, UNION OF SOUTH AFRICA.

From an engineer's notebook

EVERY age has its own particular philosopher's stone so I sometimes check any supercilious smile when talking of some of the fantastic dreams of our forbears. Some of these goals do in time reach practical reality but I doubt whether they resemble in any way the original concept. Thirty years ago, our philosopher's stone was undoubtedly atomic power and today this idea is near being a practical reality, but hardly in the terms in which it was then conceived. In those days, we were assured, that, when the secret was discovered, unlimited power would be available for next to nothing: instead it looks like being at least as expensive as any other power source. Looking back in this way makes me wonder what would be regarded as the philosopher's stone of today. Certainly one of the claimants to the favour would surely be the fuel cell. The direct conversion of fuel into electricity is a daring thought which could largely solve the nation's coal problem, not to speak of minimising the demand for capital for power stations. Unfortunately, laboratory models of the fuel cell are a long way behind any such achievement. Although certain work on high temperature cells utilises carbon as a fuel, most of the investigations are concerned with hydrogen which at first sight appears to be of limited practical value. However, reading a recent report by Mr A. M. Adams of the B.E.A., I must confess that I had not visualised some of the possibilities of such a cell if developed to commercial practicability. I had regarded the fuel cell as a means of generating electricity from fuel, but it may well find its practical application as that long needed means of storing electricity. By the use of electricity to hydrolyse water, the hydrogen and oxygen could be conveniently stored until required for use in the fuel cell to generate electricity. While this might appear to have advantages over the accumulator it is still far too early to hazard a judgment on its commercial possibilities, let alone its technical practicability. One other prospect that interested me, was the suggested use of the fuel cell for operation on low grade gases such as those likely to be available from underground gasification. I cannot help thinking that this will prove a more difficult problem to resolve since the gas is likely to contain impurities and will certainly vary in quality. However, although the outlook for the fuel cell is still obscure, its problems being furiously attacked all over the world, so that it would be unwise to guess whether this particular philosopher's stone will ever be discovered.

* * *

PURITY in the physical world is almost as difficult of attainment as ideals in the realm of politics. Even when we can succeed in eliminating the last part per million of impurity it is often more costly than the whole of the other refining processes. None the less, the search for super purity continues and, surprisingly, if materials are successfully produced in such a state they often exhibit properties different from those more familiar to us. I am reminded of this general theme by the recent announcement of the development of perfect crystals of pure iron. These are no more than one thousandth of an inch thick yet they are sufficient to show that in such a form, iron has a strength one hundred times greater than any known metallic crystal and of course it is free from rusting. We have long known of the importance of crystalline structure on properties of materials; it would seem the metallurgists have a vast field for exploration to give us yet stronger metals.

* * *

ANOTHER new device which can be considered within this field of search for purity is a form of vacuum pump based on the absorption of ionised particles of air. The principle is of course not new but I have never heard of anything resembling this ionic vacuum pump. It is intended for dealing with those last few particles of air remaining in what many of us would already regard as a high vacuum, about one hundred thousandth of an atmosphere. The pump consists of no more than a circular stainless steel box some two inches in diameter, placed between poles of an Alnico magnet and connected to the apparatus to be evacuated. Inside the box is a tungsten ring positively charged while the box walls are of negative polarity. On the application of a high voltage between these two parts, an electrical discharge takes place, the electrons emitted following a spiral path towards the tungsten anode by reason of the magnetic field. This electron stream ionises the remaining gas particles which are intercepted by carbon plates placed for this purpose within the box. This carbon adsorbs the gas and it is by this process that the internal pressure is reduced still further. The device is fascinating by its inherent simplicity and lack of moving parts and to recondition the carbon plates after use it is an easy matter to bake the whole box.

* * *

IF physicists are concerned with purity on a high intellectural plane, engineers have their own problems of keeping their equipment to a necessary standard of purity. It was for this reason that during the last war certain types of telephone relay for service use were placed in hermetically sealed containers to keep the contacts free from dirt and humidity, quite an obvious step. However, although the desired result was obtained in certain respects, it was found that erosion of the contacts increased by more than one hundred times. Since contamination from outside was impossible, the reason was sought from within, and immediately the organic materials used in the construction of the relays came under suspicion. It was believed that the erosion might have been accelerated by the presence of vapours, emitted from these materials, being present within the contact gap. A test was made with a sealed relay containing activated charcoal and immediately an improved result was obtained. Finally by the construction of a relay wholly composed of inorganic material, with glass fibre insulation and a glass body, the excellent performance originally anticipated was obtained. This is not the first time that organic materials have led engineers into trouble, but it looks as though they will be with us for some time yet despite the increasing availability of inorganics.—*E.R.G.*

SIMPLE CONTROL SYSTEMS

PART 3 Discontinuous methods are further considered in this third article

By P. D. ATKINSON, M.A., A.M.I.E.E.

IT was explained in a previous article that simple discontinuous systems can conveniently be divided into two groups. In the first group are systems in which the operation of the switching element causes (initially) a constant rate of change of the quantity controlling the switch. In systems in the second group the operation of the switch causes (initially) a constant second rate of change of the quantity controlling the switch. The dynamic performance of typical systems in each group was considered. The study of systems in the second group will be continued in this article and some general conditions for adequate damping will be deduced.

In the previous article the specific example chosen to illustrate the properties of a system in Group 2 was an a.c. voltage controller consisting of a continuously variable autotransformer driven by an electric motor. The motor was controlled by a pair of voltage sensitive relays the circuit being arranged so that if the output voltage was within v volts of the correct value the motor was not energised. If, however, the error in the output voltage exceeded v the motor was energised and rotated the brush arm in a direction such that the output voltage error was reduced.

It was shown that the response of such a system when recovering from a large initial displacement depended on the amount of friction present and on the magnitude of the initial error in the output voltage. If there was no friction the system would oscillate continuously; with friction present the system would ultimately come to rest but the motion might be oscillatory, the number of overshoots depending upon the amount of friction present and on the magnitude of the initial displacement. A practical specification for the degree of damping of a satisfactory system is that, however large the initial displacement, it should come to rest within the dead zone without overshoot.

If the initial displacement is very large the brush arm will approach the dead zone at its maximum angular velocity. It will be shown below that simple equations can be derived to specify the amount of friction necessary to achieve this degree of damping. The symbols used in the previous article will be used and for convenience they are defined below.

V = Angular displacement of the brush arm from the datum position (radians).

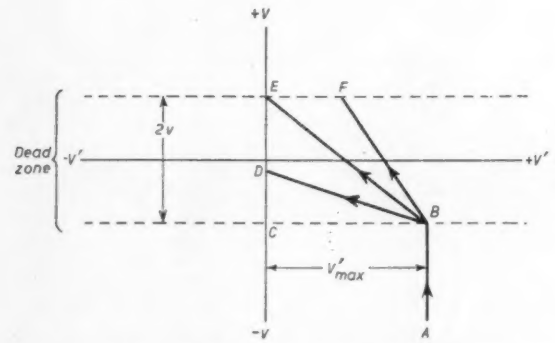


Fig. 1. Phase plane trajectories of position control systems recovering from a large initial displacement

$\pm\frac{F}{g}$ = Motor torque (lb ft).

g = Acceleration due to gravity (ft/sec²).

I = Moment of inertia of rotating parts (lb ft²).

V' = Angular velocity of the brush arm (radians/sec).

V'' = Angular acceleration of the brush arm (radians/sec²).

$\frac{k}{g}$ = Friction torque per radian per second. (lb ft/radian/sec).

In the previous article the equations of motion for the brush arm were shown to be as follows:

When V is greater than v

$$I V'' = -[F + kV'] \quad \text{.....(1)}$$

When V lies between $+v$ and $-v$

$$I V'' = -kV' \quad \text{.....(2)}$$

When V is less than $-v$

$$I V'' = -[-F + kV'] \quad \text{.....(3)}$$

When trajectories representing the motion of the system are drawn by the graphical method it is found that if the motor is switched off (equation (2) applies), the trajectory is a straight line which makes an angle θ with the V' axis, where $\cot\theta \doteqdot k/I$. It can be shown from equation (2) that this relationship is exact and this fact can be used to reduce the labour in the drawing of trajectories.

Fig. 1 shows trajectories in the phase plane of a system which approaches the dead zone at a constant velocity until the motor is switched off, when $V = -v$. To simplify the

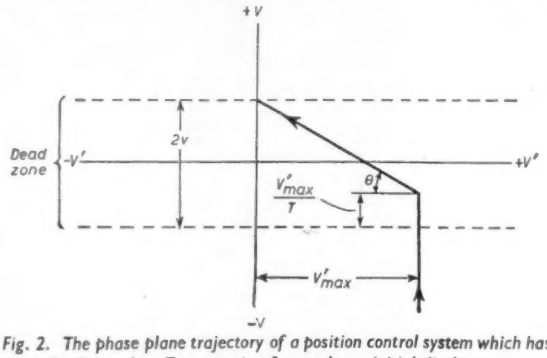


Fig. 2. The phase plane trajectory of a position control system which has a fixed time lag, T, recovering from a large initial displacement

algebra the scale p is taken as unity. The trajectory within the dead zone is a straight line and the system comes to rest when this line cuts the axis of V within the dead zone. Thus the trajectory ABD represents the motion of a system in which the viscous friction is more than enough to bring it to rest within the dead zone. The system represented by ABF has insufficient friction to prevent at least one overshoot and that represented by ABE has the minimum friction necessary to satisfy the requirement for adequate damping. To determine the minimum amount of friction required to satisfy the specification for damping consider the path ABE.

$$\text{Cot } \underline{/CBE} = \frac{k}{I} \text{ and Tan } \underline{/CBE} = \frac{EC}{BC} = \frac{2v}{V'_{max}}$$

$$\text{Then } \frac{k}{I} = \frac{V'_{max}}{2v} \quad \text{.....(4)}$$

The maximum velocity of the brush arm is reached when the motor torque is completely absorbed by friction for there is then no torque available to provide acceleration. Thus from equation (3) when $V'' = O$ we have $V'_{max} = F/k$

Substituting in equation (4) for V'_{max} we get

$$\frac{k}{I} = \frac{1}{2v}\,\frac{F}{k} \quad \text{or} \quad \frac{k}{I} = \sqrt{\frac{1}{2v}\,\frac{F}{I}} \qquad \text{.....(5)}$$

Equation (5) specifies the amount of friction required for a given system in order that the requirement for a response without overshoot shall be fulfilled. In practice it may be necessary to introduce friction artificially in order to satisfy equation (5). This practice has two disadvantages:

(i) The maximum speed of the motor is reduced leading to sluggish performance.

(ii) A large amount of power is absorbed by the brake causing excessive heat dissipation.

An alternative solution to the problem is to provide an electrically operated brake (e.g. an eddy current brake) and to arrange that this is only energised when the motor is switched off; i.e. within the dead zone.

In this case the maximum speed of the motor, V'_{max}, is determined by the motor characteristics and the inherent mechanical friction. The total viscous friction required for a given maximum angular velocity can be determined from equation (4) where k must be taken to represent the total braking torque/radian/second and thus includes that due to

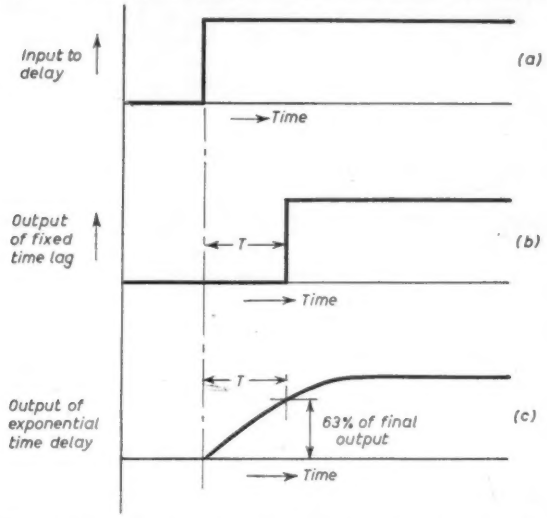


Fig. 3. This diagram compares fixed time lag with exponential time delay, outputs in (b) and (c) corresponding to the input signal (a)

the electrical brake. It is therefore possible to make k large without limiting the maximum velocity or causing excessive heat dissipation.

The Effect of Time Lag

If there is a finite time delay between the detection of a displacement and the switching on or off of the motor even more friction will be required to give a well damped response. The effect of this time lag can be introduced into the general graphical method but it will be sufficient for our purpose to consider its effect on the design criteria given in equations (4) and (5).

In the case of a shaft running in from a large initial displacement, as in Fig. 2, the motor will remain on and the switched brake, if provided, will not be applied for a time T after V has fallen to v. During this period of time the shaft will have rotated through a further angle TV'_{max} radians.

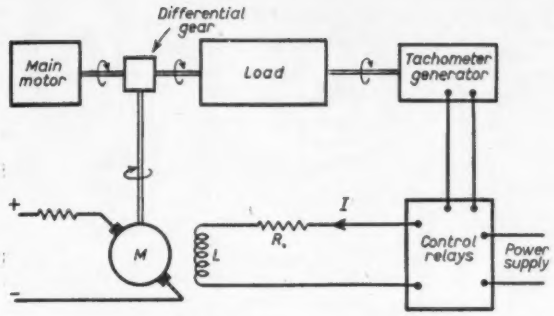


Fig. 4. A typical closed loop system using an auxiliary motor, M, to provide speed control of a main motor

Thus, in Fig. 2, $\text{Tan}\,\theta = \left[2v - \frac{TF}{k}\right] \div V'_{max}$

Then equation (4) becomes

$$\frac{k}{I} = \frac{V'_{max}}{[2v - T\,V'_{max}]} \qquad \text{.....(6)}$$

If a switched brake is not used, the equation which corresponds to equation (5) is

$$\frac{k}{I} = \sqrt{\frac{I}{2v - T\,V'_{max}}\,\frac{F}{I}} \qquad \text{.....(7)}$$

In general the effect of a time delay of this type is to cause a reduction in the damping of a given system and may even cause sustained oscillation in a system which would otherwise be adequately damped.

In some position control systems it is arranged to feed back and compare with the input quantity a signal which is the sum of the output quantity and either, the first rate of change of the output quantity, or the product (first rate of change of the output quantity)^2 $\times$ (the sign of the first rate of change of the output quantity). In this way the motor torque can be switched off and in some cases reversed before the dead zone is reached. This allows more time for the slowing down of moving parts and in the cases where the motor torque is reversed the motor is used to help the friction to reduce the speed.

The Effect of Load Torque

The moving parts of the voltage regulator discussed above are not normally subject to external forces. However, in some position control systems external forces tend to deflect the output member from its correct position. For example, an aircraft control surface may be positioned by a servomechanism but aerodynamic forces will tend to move the control surface from the position demanded by the automatic pilot. If the servomechanism is a discontinuous one of the type discussed above such an external load will cause it to oscillate continuously. This is because, in order to maintain equilibrium the average motor torque must be equal to the average value of the load torque. Since the motor torque has only two values. zero and maximum, intermediate values can only be obtained by repeatedly switching the motor on and off so that the average motor torque balances the load torque.

A practical method of overcoming this difficulty is to provide a powerful brake which is automatically applied when the output quantity is within the dead zone. If the load torque does not exceed the maximum value of the static friction torque of the brake oscillations due to this cause will be eliminated.

Time Delay in Group 1 Systems

The effect of a fixed time lag on a Group 1 system has already been considered. There is another type of time delay which is more common than the fixed time lag, it is often referred to as an exponential time delay. The difference between the two types of delay is illustrated in Fig. 3. It will be shown that the introduction of an exponential time delay into a Group 1 system renders it equivalent to a Group 2 system.

Consider as an example a closed loop system designed to control the speed of a motor driving a high inertia load, as in Fig. 4. Two motors drive the load through a differential gear. The first runs under constant power adjusted so that it supplies sufficient torque to maintain the load at constant speed. The second, which is controlled by the speed sensitive relays is used to correct speed errors which may arise due to external disturbances and small errors in the power supplied by the main motor. Since the main motor supplies all the torque needed to maintain the speed, all the control motor torque is assumed to be available for accelerating and decelerating the load.

The tachometer generator gives a voltage accurately proportional to the speed of the load. The control relays which are operated by the output of the generator are arranged so that if the error in the load speed lies between $\pm$ v the voltage applied to the field current of the control motor is zero. If the speed is more than v radians/second low, the control relays apply a voltage E to the field circuit in the sense which causes the motor to give an accelerating torque. If the speed is more than v radians/second high, the control relays apply the same voltage with opposite polarity. The armature of the control motor is supplied with direct current through a high resistance, so that the armature current is practically independent of the armature e.m.f. Thus the control motor torque can be assumed to be proportional to the field current.

Let

V = the error in motor speed (radians/sec).
V' = the first rate of change of V (radians/sec^2).
V'' = the second rate of change of V (radians/sec^3).
$+v$ = the speed error at which the "high" control relay operates (radians/sec).
$-v$ = The speed error at which the "low" control relay operates (radians/sec).
$-E$ = the voltage applied to the field circuit by the "high" relay (volts).
$+E$ = the voltage applied to the field circuit by the "low" relay (volts).
I = Field current (amp).
I' = First rate of change of I.
L = Field inductance (henrys)
R = Field circuit resistance (ohms).
J = Rotational moment of inertia of the moving parts (lb ft^2).
$\frac{A}{g} = \frac{\text{Motor Torque}}{\text{Field Current}}$ (lb ft/amp).
g = acceleration due to gravity (ft/sec^2).

The effect of the field windings is to delay the change of field current when the applied voltage is changed; it can be shown to be an exponential delay. When V lies between $\pm$v it would be unsafe simply to open the field circuit because the field inductance would generate very high voltages; in this example it is assumed that when V lies between $\pm$v the terminals A and B are short-circuited by the control relays.

By Newton's Second Law of Motion

$$J V' = A I \qquad (8)$$

And for the field circuit

$$-E = R I + (L \times \text{rate of change of } I)$$
$$\therefore -E = R I + L I' \qquad (9)$$

From (8), (J $\times$ rate of change of V') = (A $\times$ rate of change of I) and thus

$$J V'' = A I' \qquad (10)$$

From equations (9) and (10) we get

$$E = \frac{RJ}{A} V' + \frac{LJ}{A} V'' \qquad (11)$$

Similarly it can be shown that if V lies between $\pm$ v

$$0 = \frac{RJ}{A} V' + \frac{LJ}{A} V'' \qquad (12)$$

and if V is more negative than $-$ V

$$E = \frac{RJ}{A} V' + \frac{LJ}{A} V'' \qquad (13)$$

If $L = O$ the equations simplify to a Group 1 case. However, if $L \neq O$ the equations are of exactly the same form as equations (1), (2) and (3) which define the performance of a simple Group 2 system. Thus the speed control system with the delay caused by the field inductance belongs to Group 2.

Comparing the two sets of equations it is seen that EA/JL corresponds to F/I and R/L corresponds to k/I. Since the operation of the two systems is governed by identical sets of equations the performances must be identical. Thus any results deduced for one must be applicable to the other. This is an example of the general property that systems which superficially appear to differ widely may be governed by identical equations of motion and may thus have similar dynamic properties.

Returning to the speed control system, it is clear by analogy that if $R = O$ the system will oscillate continuously. If $R \neq O$ the system will ultimately reach a steady state, the degree of damping depending on the ratio R/L. The maximum value of V' is EA/RJ and the condition for the overshoot not to exceed v when the initial speed error is very large can be obtained from equation (5). If the control relays have a finite operating time T the condition for limited overshoot can be obtained from equation (6) and is

$$\frac{R}{L} = \sqrt{\frac{1}{\left[2v - T\frac{EA}{RJ}\right]} \frac{EA}{LJ}} \qquad (16)$$

Summary

The use of simple switching elements in place of continuously variable power amplifiers leads to simple, economical and compact devices. However, such arrangements have a number of important limitations. In the case of the simplest types, the output quantity oscillates continuously over a limited range about the required value; as this range is reduced the frequency of oscillation generally rises. Rapid oscillation may cause excessive wear of the contacts. More complicated types can in many cases be stabilised so that there is no oscillation but to do this additional equipment and complication may be required and the problem increases in difficulty as the speed and precision of the system is increased.

Discontinuous systems are most suitable for applications in which the input is stationary or only slowly varying. If the output quantity is required to follow a rapidly varying input quantity the discontinuous nature of the operation leads to rather jerky and frequently inaccurate following.

It is thus in the field of low cost, low performance systems that discontinuous devices are usually employed. When both accuracy and rapid response are necessary or when precise following of a varying input quantity is required, continuous closed loop systems are commonly used. The properties and stability of continuous systems will be discussed in later articles.

(To be concluded. Parts 1 and 2 of this series of articles appeared in our 1st April and 13th May issues, and Part 4 will appear shortly.)

Progress in Welding Research Last Year

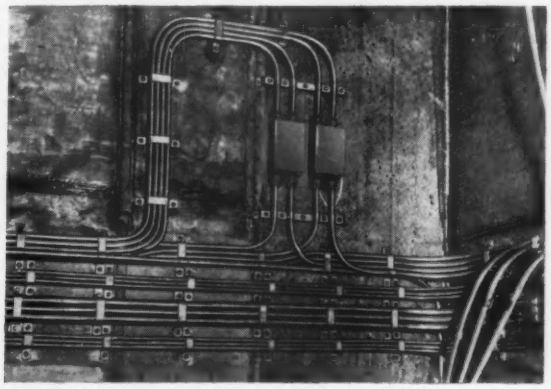
IN its report for 1953–54, the Council of the British Welding Research Association records that the Association's technical and financial progress continued at an increasing rate. Exemplifying the former aspect is the publication of 34 research reports, 50% higher than the previous year. Financially, the Association's income exceeded £100,000 for the first time, whilst membership now includes 320 organisations. Moreover, the D.S.I.R. obtained for them, in addition to the ordinary grant, a special grant out of M.S.A. funds which has enabled the Association to purchase a Sciaky three-phase spot welding machine and a Baldwin-Tate-Emery 400,000 lb universal testing machine in the U.S.A. These machines, which otherwise could not have been obtained, come as most valuable additions to research facilities.

Such is the broad picture presented in the report, and looking at it more closely, it is seen that considerable progress has been made in a variety of fields. Of work on light alloys, a fundamental investigation of the self-adjusting characteristics of high current-density metal arcs has shown that self-adjustment of the arc due to power source characteristics increases rapidly as the open-circuit voltage is reduced to the arc voltage, being pronounced as this condition is approached. A special low voltage generator, built by a member firm has given encouraging results. The work has also shown that the arc can run on a.c. at low r.m.s. open-circuit voltage when auxiliary source is employed for cyclic arc-reignition. The ideal power source may, therefore, be substantially different from that used with normal metal-arc welding.

Other work in the light alloy field was concerned with cracking experienced in welding H.10 deck units with Al/5% Si electrodes. The cracking was found to have been caused by dilution of the weld by the parent metal to produce a crack sensitive composition. Moreover, a cracking test has now been devised to enable comparisons of different electrodes for welding the H.10 alloy to be made. Billets of special alloys, produced by members, have been extruded and wire drawn by B.W.R.A. to examine their suitability as filler alloys for welding high strength, heat-treatable aluminium alloys. Results with these fillers show weld strengths higher than those obtainable from commercially available filler alloys. Original work on dilution has given valuable information on the magnitude of the effect, results indicating that joint design is the most important single factor affecting weld composition by affecting dilution factor.

Investigation into resistance welding of light alloys has been concerned with developing methods of reducing power demand when spot welding these metals and the properties of single spot welded structures in heavy gauge components. For the first problem, three-phase frequency convertor machines have been studied, with consequent accumulation of experience in their use.

Dutch Navy Adopts Aluminium Sheathed Cables



Above an installation of aluminium sheathed cable designed to be strong enough to afford a hand hold in rough water. Left is the cruiser De Ruyter in which these cables have been installed

ALUMINIUM sheathed rubber insulated cables, which have grown considerably in popularity since their commercial introduction in 1948, are now to be used extensively on board ships. Such were the results of a small experimental installation aboard a frigate that the Royal Netherlands Admiralty has decided to employ them in two cruisers and several destroyers which have been under construction during the past four or five years. Supplied by Johnson and Phillips, Ltd., the cables were not provided with protective coverings, the experimental installation having demonstrated that there is no risk of sheath corrosion when the cables are installed below decks.

Particular requirements stipulated by the Dutch engineers were that the cables should be capable of providing efficient electrical screening without excessive weight and sufficient mechanical protection without special coverings. Metal braided cables did not provide the necessary screening, whilst lead sheathed cables may have effected the weight carrying possibilities of the vessels. Among advantages conferred by the use of aluminium sheathed cables is their high mechanical strength, allowing their use as hand rails, when properly supported, for convenience in heavy seas. The high melting point of aluminium, moreover, is of considerable value in the unfortunate event of fire.

Due to the limited space available, installation of the cables presented a number of problems, although only in the more confined spaces, or where additional cables were later required, causing overcrowding, was the work unduly hindered. It seems reasonable that, by planning a ship's installation specifically for this type of cable, and by routing cables with a full regard for the sheath's characteristics, no installation difficulties need be encountered.

Power Farming at Windsor

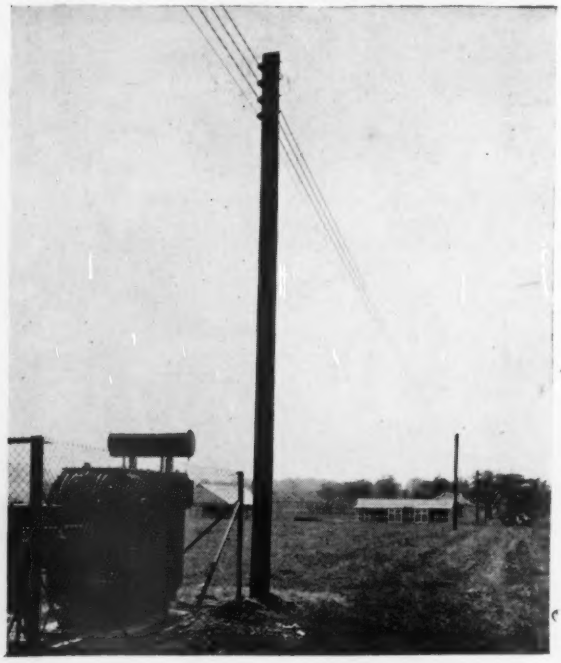
ROYAL AGRICULTURAL SHOW HOUSES 680 EXHIBITORS

RECOGNISED meeting place for all interested in agricultural machinery is the implement section of that prime event in the farming year the "Royal Show." For it provides most valuable facilities for the comparison of all types and makes of machinery on one site. In view of the progress in British farming machinery due principally to the influence of the Royal Agricultural Society of England under whose auspices the Show is held and the considerable growth of electrically-powered agricultural equipment, it is not to be wondered that the electrical installation at Windsor Great Park is a considerable undertaking.

Electrical Installation

This year the scheme has been prepared by Dale Electric (Yorkshire) Ltd., of Filey, on behalf of Mr C. H. R. Naylor, L.R.I.B.A., the surveyor to the R.A.S.E. The Southern Electricity Board has installed an e.h.t. cable supplying two substations from which the l.t. installation by Dale Electric leads through the distribution switchgear and the whole of the overhead network to the Society's buildings and the exhibitors' stands including final wiring on these stands. The network comprises approximately 6,000 yds of overhead and 1,000 yds of underground main lines. To erect the overhead lines 18,500 yds of P.B.J. aerial cable coloured green to blend with surroundings and approximately 5,500 yds of bare copper wire were used. Supplies to stands and the final wiring of the points have used approximately 36,000 yds of twin and 3-core p.v.c. insulated cable. The aerial cables and p.v.c. cables were supplied together with items of overhead line equipment by W. T. Henley's Telegraph Works Co., Ltd.

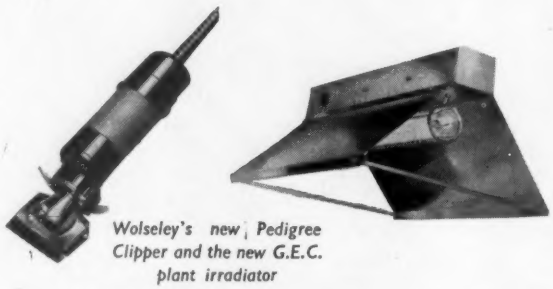
One of the 750 kW transformers and a l.t. overhead line on the site



Comprehensive exhibit

"Power on the Farm" is quite naturally the theme of the Electrical Development Association display. Apart from exhibits illustrating the way electricity is put to work on the farm, a large number of new appliances are on show for the first time. Of interest to the dairyman is the Hanovia's ultra-violet water steriliser in which water under flow up to 1,500 gallons per hour is exposed to rays from a h.p. mercury arc tube. Another new Hanovia product is a unit for killing bacteria by exposure to u.v. radiation.

An exhibit interesting to small pig and poultry farms is a 1 h.p. "Comet Minor" automatic hammer mill by Martin's Cultivator Co., Ltd. For most requirements the cost of running will be 2 units per cwt. In addition the barn section of the display has an automatic 1 h.p. oat crusher by E. H. Bentall. Venner Ltd. have one of their new time switches featured in the poultry section which is arranged for automatic lighting in yards and deep litter houses.



Wolseley's new Pedigree Clipper and the new G.E.C. plant irradiator

Separate sections of the exhibit are devoted to the various facets of farm work. Grain drying installations, floor warming heating for pigs and poultry, food preparation, dairy equipment, water pumping, workshop equipment, horticultural and domestic equipment are all featured.

Crop Treatment

Grain and grass drying, displayed by J. W. Woolley and Co., includes the Woolley Platform "in sack" dryer which employs concrete platforms with electric heater and fan units. These are available in four standard models. All models are provided with built-in switch control panels and are designed to provide a moisture extraction rate of ·6% to ·8% per hour. This company's "in tray" grain dryer was awarded a Silver Medal at last year's Bath Show, and employs a 10 ft by 5 ft by 1 ft 3 in. tray which holds approximately one ton of loose grain. J. W. Woolley and Co. also specialise in the "in-bin" type of grain drying.

The General Electric Co. also devote a section of their stand to this problem and show a 20-hole Transverco platform drier with vertically-mounted "Aerofoil" fan and heater and control panel. The cost of this plant handling 2 to 3 tons per day is only £104.

G.E.C.'s new plant irradiator is making its debut on the horticultural section of this stand. It gives 50% greater plant coverage. Embodying an aluminium reflector the unit employs an Osram 400 W MA/V soft-glass mercury lamp which gives 10% more light than the MA/H hard-glass lamp it replaces. To enable this lamp to be burned horizontally a magnetic deflector is fitted to the reflector.

Penney and Porter Ltd. are exhibiting their A1 all-electric grain drier which has been designed for use on farms with a small acreage of grain. The small amount of space required for this unit will commend itself to farmers who do not wish to make structural alterations for installation. It can be fitted with Negretti and Zambra thermostat to give close control of drying temperatures up to 150° F. The firm's "Winnograder" designed for the dual purpose of cleaning grain direct from a combine and for grading for seed. It is powered by 2-3 h.p. motor depending on capacity ranging from 80-160 bushels per hour on wheat and deals with all cereals.

Geo. W. King are making a feature of a full-size composite working unit of grain conveying and storage equipment including the Thermatic conveyor and drier (in this instance diesel-driven) electric suction grain conveyor and electric shaker grain conveyor. "Myte-min" and "Matom" electric pulleys and King electric sack hoists are shown.

Barn Machinery

Grain conveying and loading equipment is featured by Mitchell Colman and Co., whose machinery display includes Spinolift pick-up grain loaders in 20 ft and 14 ft long models with electric models; an 8 ft model with petrol engine is arranged as a working exhibit. A Tornado model T9M2 grain blower with suction attachment and electric heater is in motion conveying wheat by suction and then by pressure conveying. Mitchell Colman's new model T type fan unit with electric heater is a centrifugal fan for use in grain drying. The Yeoman pre-cleaner makes its first appearance this year at a Royal Show.

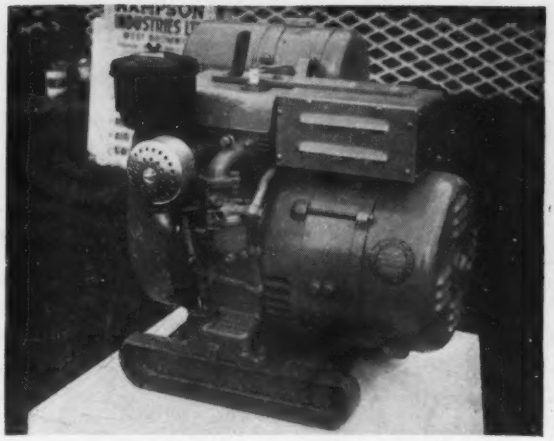
Fyna Mills have featured a Minormatic mill with 5 h.p. motor, a No. 1 mill with speed booster, a No. 2 mill with 15 h.p. motor and a No. 4 mill with speed booster. The Minormatic and No. 2 mills are shown in operation. Scottish Mechanical Industries new Stockfeed mincer is continuous in operation and prepares without water 2 to 4 tons an hour of roots, brassicas, potatoes and oil cake for pigs, cattle and poultry. Driven by a 3 h.p. motor or from the Scotmec Pickup motor, this unit prepares a fine pulp which prevents the pigs from leaving the less tasty but essential parts of their ration. This new Pickup motor enables one motor to drive a number of barn machines without the use of line shafting. Incidentally this firm's Electromatic Hammer Mill is now being distributed by Massey Harris-Fergusson Ltd.

Interesting Whitlock Bros. exhibits include above and below floor meal and mash mixers for electric drive having an output of 3 tons per hour and electric sack-lifters, whilst Christy and Norris are showing several of their Essex Major Mills (3 h.p. motors), some of the range of Bition grinders including two, the LB4/2 and LB7/2, for 10 or 15 h.p. motors. A 10 cwt batch mixer displayed is supplied with 3 or 5 h.p. motor for mixing pig and poultry food.

Cooch and Sons Ltd. are showing a range of potato sorters, a winnowing machine, a vegetable washer, and a fruit grader, these are shown driven by petrol engine belt. We understand from the makers that in practice the winnower and fruit grader are invariably electrically powered. The demand for electric drive on the potato sorter is increasing and one model will be shown on E.D.A.'s stand. The fruit grader works on a new principle and will separate small sizes first or vice versa or will group two sizes together.

Pigs and Poultry

W. L. Holland Ltd. are showing for the first time a vertical mixing machine for dry mash. It has a capacity of 10 cwt, is powered by electric motor and can be filled and emptied on the same level. The firm has also introduced a special elevator for filling their Adelphi mixers in any size from 3½ cwt upwards.



Hampson Industries 1·6 kW 230 V a.c. petrol generator set

Swifts, of Scarborough, have featured a "Snowhite" egg washing machine which handles 2,000 eggs per hour. It saves poultrymen hours of drudgery and leaves the eggs with the "bloom" appearance of a new laid egg. Four models are available, one, a table model, has a built-in ¼ h.p. motor for 230 V a.c., whilst two others are motor-driven stand models, one with a wind tunnel drying attachment. Stephens Cabinet Incubator Co. have on display a cabinet incubator, Golden Jubilee incubator and a full range of Glevum Appliances, whilst Papworth Industries have their No. 175 and 125 incubators, these are of 6,480 and 2,688 egg capacity with 27 and 18 turning egg trays. Three 500 W strip heaters and ·34 h.p. motors are fitted in the former and two heaters in the latter. A feature of these models is the joltless turning of the trays preventing damage to the egg. Secura Incubators have this year introduced their 2112 model this year as an all-electric model on similar lines to their 1408 model. Incidentally, a model 4224 incubator is on show on the E.D.A. stand. Curfew Appliances have their observation incubator in operation hatching chicks. Curfew also make a 2,000 egg per hour washing machine, a machine for washing wire floors and droppings trays, 23-gallon, 45-gallon and 52-gallon electric food steamers and infra-red rearers.

For the first time at the Royal Show Wolseley Sheep Shearing Machine Co. are showing their new range of electric fence equipment specially designed for folding pigs and sheep. New hairpin posts and corner insulators are featured. In addition they are showing a new mains electric fencer unit. The fencing equipment shown by Harvest Saver and Implement Co. is, however, designed for 6 V battery operation only, whilst Cooper Stewarts new Mark V Fencemaster is for 120 V dry battery operation. Cooper Stewart specialise in electric shearing equipment and are featuring many of their models. Wolseley Sheep Shearing Co. however are featuring for the first time in England their new Pedigree horse and cattle clipper, it weighs 44 oz. and, available for mains operation, can be handled easily with single-handed switching.

Yorkshire Copper Works specially constructed demonstration vehicle will be at the show and will feature the modern method of laying by mole plough "Yorcalon" copper tubing. Two miles of this long length tubing have been laid by this method to provide part of the water installation at the Royal Show.

H. J. Godwin electric pumps on display included their

jet-type pumps, type A.1.E. shallow well pump and type E.O.E. deep well pump (over 25 ft depth). British Thomson Houston have featured electrically-driven pumping pumps amongst their displays of motors, control gear, industrial heaters and Mazda lighting equipment, whilst Lister equipment includes a full range of pumping sets. Apart from their electric shearing and clipping equipment Listers feature dairy equipment including a 135 gallon per hour separator with built-in electric motor.

Dairy Equipment

The well-known range of Simplex equipment is featured at the show, whilst J. W. Woolleys again have their Electrobloc and Woolley Whizzer steriliser. Purlac Equipment have their Inchurn Cooler which is available in 3 sizes. Steam boilers and sterilisers are featured by Barford (Agricultural) Ltd., their 15 kW model evaporating 55 lb of water per hour. Models rated at 7½, 22½ and 30 kW and sterlising chests loaded 4, 6, 9 and 15 kW are supplied.

The Fullwood milking machine featured by R. J. Fullwood and Bland is one of the most efficient units available. The rotary vacuum pump may be driven by motor or engine. For the small herd the "Midget" installation requires a ½ h.p. motor, whilst the "Universal" milker (½ h.p. motor) is an economical direct to churn plant for the small herd, whilst the company's Coldflow cooler is available in three models, 80 gallons per day to 45° F, the 150 and 220 gallons.

Powered Appliances

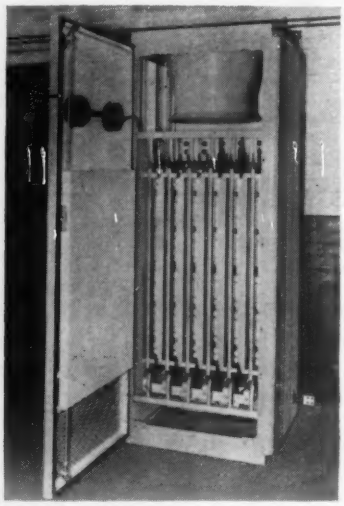
As a source of motive power, the electric motor has many advantages over other forms, and is capable of being incorporated into appliances ranging from the recently introduced 9 in. heavy duty electric saw, by Black and Decker, to portable electric hedge trimmers, one of many handy appliances shown by the Tarpen Engineering Co. Another electric saw, adaptable for cutting either timber or stone is the "Avon," seen on the Canavon Partners stand, whilst the Walter A. Wood Co. feature an electric motorised saw bench, the "Arun," which is available in four sizes. For versatility in application, the "P.U.P." service unit, by Maxim Engineering Ltd., must come high in the list; it is a pneumatic unit suitable for spraying, dispensing grease or air blowing among others, and can be powered by a ¾ h.p. motor. For farmers wishing to build their own machinery, Hoover display a range of f.h.p. motors suitable for a variety of purposes.

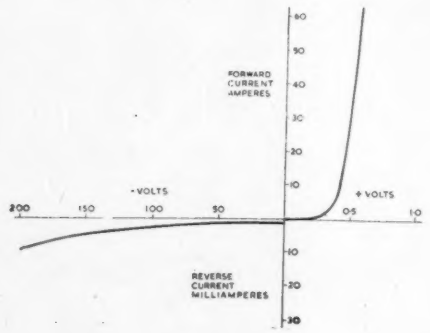
Generating sets are being shown for use on sites where an electricity supply is not yet available. A. C. Morrison (Engineers) Ltd. feature the advantages of electricity in a display supporting their range of petrol and diesel-driven generators, latest of which is a 150 A, diesel arc welding set. Another in this sphere is the 200/300 A single operator arc-welding generator featured by Murex Welding Processes, whilst on Hampton Industries stand can be seen portable generating sets, ranging from 500 to 1,600 W.

Power Rectification from Germanium

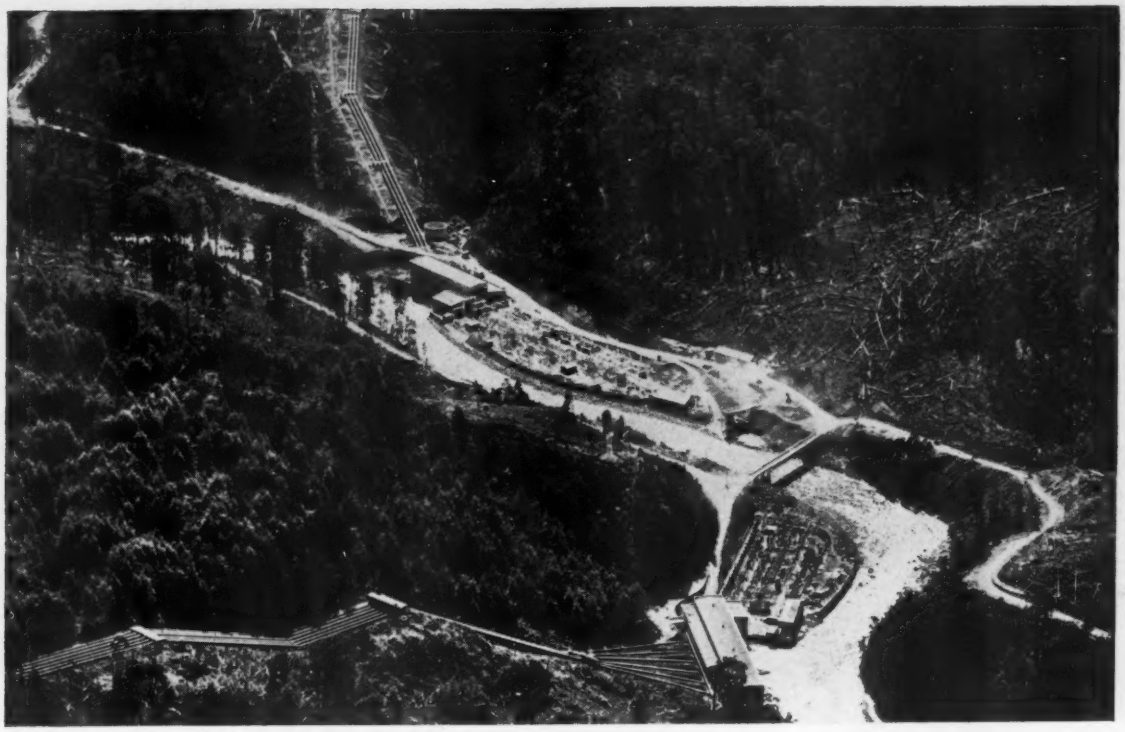
WHAT is believed to be the first application this side of the Atlantic of germanium to power rectification went into operation last December, when the British Thomson-Houston Co., Ltd., put into service a 300 kW, 1,100 amp germanium type rectifier at their Rugby works, almost exactly a year after its development was initiated. The rectifier stems from intensive technological development undertaken by a team of B.T.H. engineers and physicists, who succeeded in stepping up the value of current obtainable from a germanium cell from a fraction of an amp to 50 amps. This cell now forms the basis of the 1,100 amp equipment which, at 270 V, is now used to supply an electrolyser, having been in almost continuous service since 21 Dec. on loads varying up to its maximum rating. The efficiency experienced with this equipment has been some 98·5%, a performance which, it is hoped, further equipment will better.

Day to day experience with this first unit is being recorded, but considerably more work has yet to be done before germanium may be used on a wide scale for power rectification. The suitability of the metal as a rectifier for different types of service must be considered, and, to this end, a further unit is due to be installed shortly on a different service at Rugby. Quantity production, therefore, has yet to come, but it is expected that progress during the second year of the development will be commensurate with that made during the first year. If this expectation is realised, a means of power rectification at high efficiency will, it is claimed, soon become available to meet industrial needs.





Illustrations on the left depict, extreme left, the 300 kW germanium rectifier cubicle prior to instalment, and near left, the completed cubicle showing the interior assembly of germanium cells. The diagram above displays the rectifier characteristics at 20°C



Sets for Tungatinah

PROGRESS WITH 125 MW STATION MARKS STAGE IN TASMANIAN DEVELOPMENT

TASMANIA has a water power potential amounting to more than ten horsepower per head of population. Since 1892, continual attention has been given to the development of this great natural source of wealth, and at present the major project is the complete development of the River Derwent catchment area. This river and its tributaries flow south-east from the centre of the island, and amongst recent development works has been the Tungatinah power station, which has an ultimate capacity of 125 MW. At the present time this station has three 25 MW sets on load.

The station is fed with water from reservoirs and diversions controlled by a number of dams with heights up to 120 ft. The final path of the water to the station is a tunnel of 231 sq ft cross section, which is driven through the hills surrounding the station, and five steel penstocks each 3,200 ft long and of 90 in. maximum diameter.

The generating plant planned for the Tungatinah station centres in the turbo-alternators already mentioned. The alternators have all been supplied by the General Electric Co., and they are coupled to Francis turbines of Boving manufacture.

Each of the alternators is rated at 31·25 MVA, for 0·8 p.f. operation. Generation is at 11 kV for a three-phase 50 c/s supply, the machines being of ten pole construction (600 r.p.m.). Vertical shaft construction is employed, with a combined thrust and guide top bearing and a bracket mounted bottom guide bearing. Above the main alternator is mounted a single unit consisting of main and pilot exciters and permanent magnet governor alternator all on one shaft, with the overspeed trip device.

The water turbines are rated at 35,000 h.p., and operate under a static head of 1,005 ft. They are designed for an overspeed of 1,050 r.p.m.

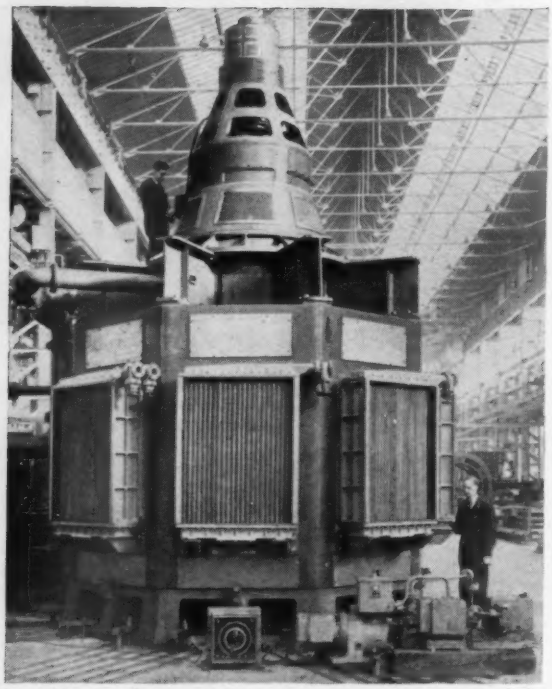
One of the problems of carrying out the contract was to construct the alternators so that no single part weighed more than 35 tons; this with a machine whose final assembled weight was to be 175 tons. The stator was split and despatched in two parts, while poles with their field coils were removed from the magnet wheel and such items as the exciter unit and bearing arms were made up as separate loads.

Stator and Rotor

The stator of each alternator is a heavy fabricated structure of octagonal shape. The core follows normal practice in being built up from segmental stampings secured by dove tailed keys bolted to longitudinal ribs within the frame. A two layer diamond winding is used with class B insulation throughout. End windings are strapped to Permali supports which join on to the core clamping plates. Aluminium guards combine the duties of protecting the end windings and guiding the cooling air through the machine. Embedded thermocouples are provided for temperature indication.

The rotor is designed for a safe overspeed of 75%, giving a top speed of 1,050 r.p.m. to match that of the turbine. Shaft and coupling are forged in one piece. Twelve

Tungatinah is seen in the course of construction in the background of this general view of the Nive River



The alternator cooling system is clearly shown in this view of the machine erected for works tests. There are eight coolers

plates are shrunk and keyed on to the shaft to form the rotor body into which the laminated poles are T-slotted, taper keys being used for securing them. Duralumin wedges are fitted between adjacent pole windings and secured to the rotor body to prevent circumferential movement. A damping winding is provided by means of copper rods in the pole faces which are connected together by duralumin rings.

At each end of the rotor there is a centrifugal fan which circulates cooling air; the lower fan incorporates the braking ring.

The main Michel type bearings are designed to carry a total load of 270 tons. Doors in the bearing housing give access for maintenance attention to the thrust pads. To obviate the risk of current circulating through the rotor shaft, thrust and guide bearings are insulated from the supporting structure.

Exciter and Auxiliaries

The main exciter is arranged for separate excitation with a counter shunt winding, while the pilot exciter is compound wound. Initial adjustment in the pilot machine is effected by a shunt field regulator.

The brush gear for both exciters, together with the alternator slip-ring is mounted within a fabricated stool situated between the two exciters, the brush gear being supported on adjustable yokes. Cupro-nickel slip-rings are used, and these are mounted on an insulated hub which is pressed on to the shaft and keyed to it. An insulating barrier between the rings ensures that there is adequate creepage distance.

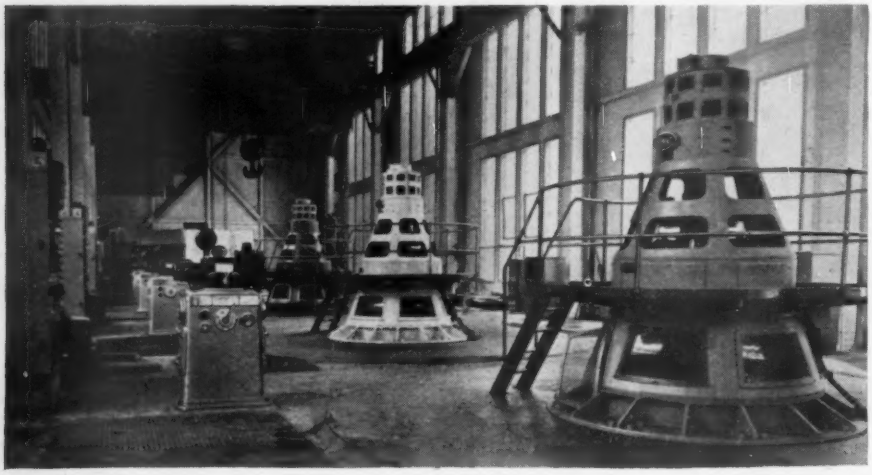
The fans which propel the air through the cooling system have already been mentioned. A closed circuit is employed, the air being drawn from the alternator pit, and passed through coolers before being returned to the pit. The coolers are arranged in eight sections around the shell of the machine, and they are designed and manufactured by the Premier Cooler and Engineering Co. With a cooling water inlet temperature of 27° C, and a rate of flow of 616 g.p.m., the complete cooler assembly will reduce the temperature of 63,000 cu ft of air per minute through 21 degrees to 35° C. Any seven sections of the cooler are capable of dissipating the 700 kW of full load losses associated with each machine.

A motor driven pump is provided to circulate oil from a 1,000 gallon tank to the alternator bearings. An Auto Kleen strainer and a Serck oil cooler are incorporated in the oil circuit. The pump is driven by a 20 h.p. s.c. motor, and there is a similar pump as a standby, for which is provided a d.c. motor powered from a separate source of supply. A standby oil cooler is also in reserve. All bearings are fitted with mercury in steel thermometers, which incorporate contacts to operate an alarm at 68° C and to shut down the set at 80° C.

Braking and jacking equipment on the alternators is supplied by Jones Tate and Co. There are five rams, equally spaced, which act on the brake ring. The top of each ram forms a flat plate which carries a heavy brake lining. The rams can be operated at high pressure to jack up the magnet wheel and allow an unrestricted flow of oil through the thrust bearing prior to starting, or to allow maintenance work to be carried out. The oil for the braking and jacking system is obtained from the turbine governor circuit.

Each complete machine is operated from a turbine gauge panel on which is mounted all the controls associated with the various indicating and alarm systems which have been mentioned. There is a 125 V d.c. supply for operating the solenoids used in conjunction with the jacking and braking oil circuit, the valves being spring closed and electrically opened.

The information on which this article has been based has been supplied by the General Electric Company and by the Hydro-Electric Commission of Tasmania.



Interior of Tungatinah Power Station, showing bearings and exciter units

PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Interference Source

A CLIENT was connected up with the mains supply and subsequently purchasing a new radio set complained of the latter being faulty. On warming up, the set gave voice to a very pronounced tap-tap-tap on the long waveband, not unlike a very active woodpecker!

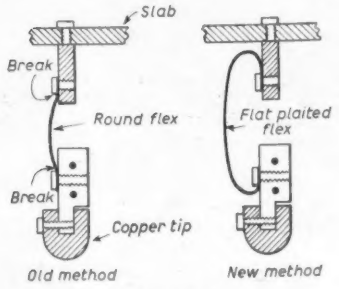
The consumer, a farmer, was some half-mile from his nearest neighbour and a further three-quarter mile from the feeder pillar, so arming ourselves with a battery portable we proceeded to isolate the farm completely, by withdrawing the main cutouts in a nearby outhouse. A very faint tapping was still audible. A search further afield was indicated and upon enquiring in the village it was found that a large majority of listeners were affected by the interference, and a search revealed nothing. It was decided therefore to isolate feeders radiating from the pillar, all except one—the supply to the local maternity hospital, and still our "woodpecker" tapped on!

The culprit was therefore either on the h.t. intake or at the hospital, and it was decided to investigate the latter. Eventually, the offender was found, a small refrigerator whose unearthed single-phase motor on a rubber mounting was rocking merrily away against surrounding earthed framework.

An insulation test revealed that the starting capacitor attached to the motor, although in working order had broken down to "earth" and was discharging itself each alternate swing of the motor against the frame. The machine was so connected that the neutral, some four volts above earth potential, was leaking away in this manner without rupturing the fuses. Another capacitor was fitted and proper "earthing" carried out, after which no further trouble was experienced.—*B.O.T.*

Flexible Connections

BEFORE the war I was having a great deal of trouble with the flexible connections on a star/delta starter switch. The connecting contact leads were bolted both to the stationary contact fixed to the underside of the slab and to the moving contact as shown in the diagram. The switch was operated from ten to twenty times each day, and after a month or six weeks the leads broke off near the point at which they were fastened to the upper fixed contact.



Flat plaited flex in the switch contact connection

To remedy the trouble I used a flat plaited copper flex soldered at each end for drilling purposes which instead of being connected straight down to the moving contact was fitted in a large loop. The movement instead of being direct on to the bolt was now in the upper part of the loop. The result was a considerable saving in wear, the connections being as good now as when they were first made seventeen years ago.—*G. A. L.*

Makeshift Armatures

SHORTAGES created during the war years, were overcome in many ingenious ways. The writer, when taking over the electrical workshop at Ceylon base workshops, found the following method in use to reclaim the windings of 6 V vehicle generators.

Owing to the humid atmosphere of the island, a large percentage of the armatures were burning out. Replacement armatures of suitable wire for re-winding were almost unobtainable, which coupled with a sharp increase in the number of vehicles in use, gave rise to a difficult position. The windings were carefully removed from the burnt out armatures, the insulation burnt off and the wire heat annealed in an electric oven. After pulling out straight, and dipping in insulating varnish they were hung up to dry. The lengths of wire were about 6 ft.

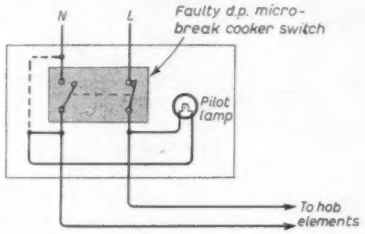
These lengths were then rotated between an electric motor and ball race to spin cotton on by hand, this was rather a difficult operation, but had been mastered by local labour and the resulting d.c.c. wire compared very favourably with the normal factory product.

Fortunately most of the vehicles being Canadian/American Fords and Chevrolets, in which the generators were mostly 6 V. It was found that 12 V generators could not be treated in this manner, as the windings being consequently thinner and more numerous, could not be accommodated in the armature slots, the spinning method described producing an insulation slightly thicker than the usual winding.—*W. Satchwill.*

Pilot Lamp Connection

RECENTLY I was sent to investigate the cause of a consumer receiving an electric shock whilst cleaning her cooker. On my arrival, the consumer gave me minute details of what had happened, stating that, firstly, she switched off the cooker control unit, raised the top, afterwards removing the hot plates and grill. Then, with a damp cloth, she commenced cleaning the inside of the hob and hot cupboard. It was whilst doing this that she drew the cloth across one of the female plate connecting blocks and received a shock. To aggravate matters she had been standing on a stone floor.

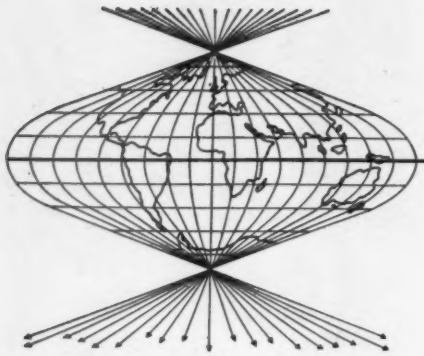
As a first step, I decided to test with the supply on to see if anything abnormal was taking place. Everything, however, seemed quite in order. I then switched off the d.p. cooker switch, which was of the type incorporating a pilot lamp as an on and off indicator. The pilot lamp went out, so I then tested the cooker, finding, to my surprise, that there was full voltage to earth from the neutral.



The new connection (shown dotted) of the pilot-lamp in the cooker unit

There was then nothing left for me to do but start breaking the circuit down piece by piece. I began with the control unit, soon discovering that here was the cause of the trouble. Whilst the neutral connection in the switch had broken, putting out the pilot lamp, the line connection had remained closed. As can be seen from the attached sketch, the closed line connection, via the pilot lamp, was causing the neutral conductor to rise to virtually line potential. Hence anyone touching the neutral and in contact with earth received a shock.

In the course of repairing the faulty cooker switch I altered the neutral connection of the pilot lamp to the supply side of the switch. This then provides a permanent neutral return for the lamp, giving immediate indication of faulty operation of the line contacts.—*J. W.*



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

ALASKA

Nearing Completion

With construction work progressing well it is anticipated that the Eklutna hydro-electric project, in Alaska, will be in operation by Nov. next. The first of the two 15,000 kW generators is now being installed. The plant will utilise water from Eklutna lake, some 36 miles north of Anchorage, an area which is anxiously awaiting the operation of the station. Work on the project has been under way since July, 1950, when a new U.S. Federal law authorised the Federal Secretary of the Interior to construct the first Alaskan hydro-electric project. But Eklutna is really the first positive result of a power survey made in the northern territory some ten years ago by the Federal Government. That survey showed that the territory has a potential of 50,000 million units of firm hydro-electric energy. The present work involved the drilling of a four-mile long tunnel from Eklutna through Goat Mountain. Estimated cost is put at $29\frac{1}{2}$ millions.

CANADA

H.E. Survey

Engineers of the British Columbia Power Commission have begun a survey of the Helmcken area of the Murtle River, a tributary of the Clearwater, about 90 miles north of Kamloops. The survey, which is likely to take most of the summer, will obtain data on the possibility of a hydro-electric development to provide another major source of power for the central interior. It is believed that the Falls site could provide 70,000 h.p. to 100,000 h.p. should the project prove feasible. The Power Commission has been studying the area for an additional power source to feed into its Kamloops-North Okanagan transmission system now served by the Whatshan and Shuswap Falls hydro plants.

Moves in New Brunswick

The Shawinigan Engineering Co., Ltd., of Montreal, have been appointed as consulting and designing engineers for the Beechwood hydro-electric project on the St. John River, which is being carried out by the New Brunswick Electric Power Commission. Initial development of the scheme is based on the installation of two 45,000 h.p. turbo-generators, and a third machine will be added later. The station would be a run of the river plant. Studies of the International Joint Commission indicate a potential of 374,000 h.p. being obtainable on the St. John River between Fredericton and Grand Falls, the three approved sites being at Morrill (88,000 h.p.); Beechwood (135,000 h.p.) and Hawkshaw (151,000 h.p.). In announcing the appointment of the consultants, Hon. Edgar Fournier, chairman of the New Brunswick Electric Power Commission, disclosed that a separate agreement had been made under which the Shawinigan Engineering Co. will also advise on the design and development of the provincial high voltage power system, including substations and communications.

Long Service

The first hydro-electric development to deliver power to Winnipeg, the Pinawa plant on the Winnipeg River, is now being dismantled. The plant started operating in 1906 with an installed capacity of 19,000 h.p. which in later years was increased to 30,000. The plant was closed down in 1951 so that water flow required for its operation could be diverted to provide the maximum 225,000 h.p. capacity of the nearby Seven Sisters power station.

The Saskatchewan Scheme

The Saskatchewan Government has committed itself to contribute nearly $73 millions of the total cost of the South Saskatchewan river irrigation and power project. This has been revealed by the Provinces Premier, Mr. T. C. Douglas. The whole cost of the project, including construction of the dam and of irrigation and hydro-electric works, is estimated at $135 millions. The Federal Government's investment, on those estimates, would be $62 millions. The plant is expected to cost $20 millions and the province government are also prepared to pay $17,860,000 as a contribution to the construction of the dam and all the work contained therein, making the provinces total commitment $37,860,000, plus $35 millions as the estimated cost of the irrigation works. Mr Douglas said this offer of the Saskatchewan Government should give ample encouragement to the Government of Canada to proceed with the construction of the project at the earliest date.

U.S.S.R.

Atomic Power

The first electric power station using atomic energy began working in the Soviet Union on 27 June, according to a radio announcement. The station has a capacity of 5,000 kW. It was said that the station was producing current for industrial undertakings and for agriculture in the nearby area. The site of the power station has not been disclosed. According to the statement, Soviet scientists and engineers are engaged on work to set up industrial power stations worked by atomic energy with a capacity of 50 MW-100 MW.

POLAND

Heat and Power Scheme

Preliminary work has started on the construction of a combined electric generating plant and central heating scheme in Lodz, the second of its kind in Poland. All the mechanical details and specifications have been prepared by Polish engineers, and some sections of the plant will be provided by manufacturers in that country, but other equipment is being supplied from outside, we understand.

MIDDLE EAST

Small Stations Favoured

In Jerusalem, the chairman of the Inter-Ministerial Power Planning Committee has expressed his opposition to the building of large power stations. In his view it is better to erect small stations, for security reasons. He has also suggested that these should be dispersed throughout the country in underground structures. In addition to the present stations in Tel Aviv and Haifa, and the two proposed for the south and the Jordan-Kinneret region, ten small stations should be constructed. Three diesel generators would soon be erected along the Yarkon-Negev line. Equipment for eight 5,000 kW stations has already been ordered with Reparations funds.

AFRICA

Rhodesia's Plan

A four-year development plan for the Federation of Rhodesia and Nyasaland, outlined in a White Paper presented in the Federal Assembly last week, estimated expenditure on a variety of schemes such as roads, communications, electricity, agriculture and industrial development at about £75,580,000. The plan includes the provision of £15,500,000 for a hydro-electric project, although the particular scheme is not specified. (But it seems likely that the Kafue project is in mind, for Sir Malcolm Barrow, Minister of Commerce and Industry, recently stated that the total capital cost of the first stage of that scheme was estimated at £33½ millions—the Kariba Gorge project would be about £50 millions.) The White Paper also refers to the increase in the generating capacity of the Southern Rhodesia Electricity Supply Commission, involving an expenditure of some £7 millions.

INDIA

Acquisition Bill

The Madras Assembly has passed the Electricity Undertakings Acquisition Bill empowering the Government to take over electricity undertakings in the State belonging either to local authorities or private concerns, on payment of compensation. The Bill re-enacts a similar law passed in 1949 which was held invalid by the Supreme Court on several grounds. Such matters have now been altered, and the provision regarding compensation amended to remove discrimination. In moving the Bill, the Public Works Minister said it was the intention of the Government to first acquire only those undertakings which did not function efficiently. In the case of others, it was his idea to draw up a programme of expansion which they would carry out either in co-operation with the Government or by themselves. Early notification would be given to undertakings to be acquired.

Calcutta Railways

The Government of India have sanctioned the expenditure of over Rs. 118,570,000 for electrification of the railway line between Howrah and Burdwan via Bandel and the branch line from Sheoraphuli to Tharakeshwar branch in West Bengal. This project is the first stage of a larger scheme for electrification of suburban lines around Calcutta, to which we have already referred. The Howrah-Burdwan line covers a distance of 66 miles and Sheoraphuli-Tharakeshwar nearly 22 miles. Work on the scheme will begin shortly and it is expected to be completed in three years. Completion of the scheme will greatly reduce traffic congestion on the Howrah-Burdwan section.

AUSTRALIA

Melbourne's Agreement

A new five-year agreement between the State Electricity Commission of Victoria and the Electric Supply Committee of the Melbourne City Council has been drawn up covering the operation of the new £3,600,000 installations at the Council's Spencer St power station. Under the agreement the Council is to operate the power station and install additional plant as directed by the State Electricity Commission, maintain the plant at full capacity and supply replacements, and sell the output to the Commission. The latter will pay all operating and maintenance costs, and interest and depreciation charges. The council, which will distribute electricity to its consumers, is to pay the S.E.C. for the electrical energy at a rate set out in the schedule. The chairman of the committee, Cr O. J. Nilsen, has said that the council's obligation to maintain the plant capacity at 84,000 kW could involve the council, at some stage, in an estimated expenditure of another £2 millions to replace existing old plant.

Acquisition in Queensland

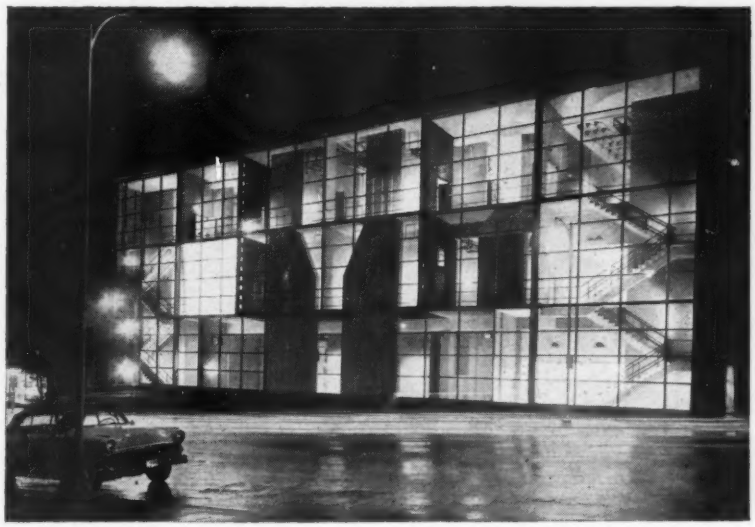
Another merger of supply undertakings in Queensland seems imminent. The Southern Electric Authority of Queensland has offered to purchase the issued shares of the Toowoomba Electric Light and Power Co., Ltd., which at present supplies around 15,000 consumers. The company has its own diesel generating plant but also take a large bulk supply from the Southern Electric Authority. At the offered price of 24s. 6d. per share the Authority would pay £866,075 for the undertaking. Under existing agreements it could have given six months notice to the company of its proposed acquisition, but apparently this share deal is simple and avoids considerable legal and other expenses that are inevitable in the execution of a State acquisition order. According to local reports it seems that the next major electricity unification move in Queensland may be for the Southern Electric Authority to take over the Brisbane City Council's electricity dept.

Atomic Laboratory

The proposal that the Australian Atomic Energy Commission should establish its first research laboratories in Sydney, N.S.W., has drawn a protest from Mr Playford, Premier of South Australia. In this he is supported by Professor Oliphant who maintains that South Australia has undoubted claims for the laboratories in that the State has pioneered and has shown much enterprise in its uranium development programme. The State stands to benefit tremendously from the production of atomic power, but Prof Oliphant also feels that the recruitment of skilled technical staff might be easier in Sydney than in Adelaide.

Extension Lines

The State Electricity Commission of Western Australia proposes to extend its 66 kV transmission lines from Welshpool industrial area to the East Perth power station. The new lines will be erected on 50 ft high wood poles, it is stated.



Is this substation in Vancouver an indication of the trend for city substations of the future? Our photograph alongside is of the Dal Grauer substation, the showpiece of nearly 40 substations erected by the British Columbia Electric Co., Ltd., since 1946. Serving the downtown area of Vancouver, the substation is fed by 60 kV gas pressure underground cables. Two 25,000 kVA transformers are at present installed; a third is to go in this year, and a fourth will be installed at some future date. Twelve 4 kV distribution circuits are presently installed, but the design calls for the installation of 36 circuits ultimately. Extensive air-conditioning equipment will maintain even temperatures during summer and winter. Electrostatic equipment removes dust from the air, thereby reducing the amount of insulator cleaning required. The station is normally unattended, being remotely controlled at load dispatch headquarters. Incidentally much of the downtown area of Vancouver has undergone major reconstruction in recent years. Many of the old dwellings have been demolished to make room for modern houses and flats, where automatic cookers, washers, dryers, refrigerators and other appliances are now in use

Personalities IN THE INDUSTRY

Mr Alan N. East, C.B.E., M.I.E.E., formerly chief engineering inspector to the Ministry of Fuel and Power, has been appointed sales consultant to Bryce Electric Construction Co. Ltd.

After forty-three years service with the British Thomson-Houston Co, thirty-five of which have been spent on a.c. motor design. Mr **W. McConnachie,** A.M.AMER., I.E.E. is retiring. He joined the BTH Test Dept. in 1913 on completing a course at the Royal Technical College, Glasgow. In 1919—after war service—he became a member of what was then known as the A.C. Engineering Dept. at Rugby and eventually became recognised as an authority on the fundamentals of a.c. motor design. In particular, he made valuable contributions to the early development work on change-pole motors, frequency changers and stator and rotor units for the machine tool and mining industries.

Mr Bryan Donkin, B.A., (Cantab.), M.I.E.E. M.AM.I.E.E., M.SOC.C.E. (France), has accepted the invitation of the Executive Council of the Association of Supervising Electrical Engineers to become President in succession to Mr C. T. Melling, M.SC.TECH., M.I.E.E., M.I.MECH.E., who is retiring after two years in office. Mr Melling will introduce the new President at the first meeting of the London National Lecture session on 26 Oct. Mr Donkin is the son of the late Mr Sydney Bryan Donkin, who was President of the A.S.E.E. during 1928-1931, and great-great-grandson of the late Bryan Donkin, who with Thomas Telford and others was instrumental in founding the Institution of Civil Engineers in 1818. Mr Donkin was educated at Gresham's School, Holt, Norfolk, and at Pembroke College, Cambridge. He was a post-graduate apprentice with the English Electric Co. Ltd, and then spent a year with the General Electric of the U.S.A. at their Works at Schenectady, N.Y., and Pittsfield. On returning to England he took a post as assistant engineer with Kennedy and Donkin, the consulting engineers, and was made a partner in 1933. He has been mainly concerned with high voltage transmission lines and substations for the Central Electricity Board, and more recently for the B.E.A., and is at present engaged on part of the 275 kV Super-Grid. He is also interested in combined generation of heat and electricity for industrial purposes and for district heating.

Mr Bryan Donkin

Mr M. Crookes

Mr E. Ll. Morcom, vice-chairman of Belliss and Morcom Ltd, has relinquished his seat on the Board. **Mr Alfred Morcom** has been appointed an additional director.

Chief accountant to the London Electricity Board, **Mr H. J. Mellows,** F.C.I.S., F.A.C.C.A., is to retire in October next, we learn. Mr Mellows became deputy chief accountant to the Board on nationalisation of the Industry, and was promoted to chief accountant in 1949. He has been associated with the industry since 1911 when he joined the St. James' and Pall Mall Electric Light Co., of which undertaking he became accountant in 1928 and manager in 1934. On the formation of London Associated Electricity Undertakings Ltd, in 1935, he was appointed chief accountant of the group.

Appointed as power station superintendent at Blackburn Meadows power station, Yorkshire Division, B.E.A., is **Mr M. Crookes,** ASSOC.I.E.E., who, since 1949, has been deputy station superintendent at the Neepsend power station, Sheffield. Earlier he was operation engineer at Neepsend after serving at Blackburn Meadows power station from 1946 to 1948 as shift charge engineer. Previously, for seven years he held a similar post at the Neepsend power station. Mr Crookes takes up his new duties on 1 Aug.

Mr W. Haynes and **Mr E. W. Spalding** have retired from the board of Ruston and Hornsby Ltd.

Mr Ronald E. Jordan, assistant telecommunications controller, Midland region of the G.P.O. at Birmingham, has been appointed telephone manager, Aberdeen area, in succession to **Mr S. J. Smith,** A.M.I.E.E., recently appointed to Scotland West area.

Head of the Department of Physics at the University College of Wales, **Prof R. M. Davies,** D.SC., PH.D., has been appointed vice-principal there for a period of two years from 1 Oct. next.

Mr A. Coppock, M.S.M.A., has now been appointed sales manager of Universal Boilers and Engineering Co., Ltd. in succession to **Mr J. S. Selley.** After serving his apprenticeship in electric power engineering with the Burnley Corporation Electricity Department, and following a period as junior charge engineer, Mr Coppock was for several years in charge of the department's sales organisation. In 1935 he was appointed as sales engineer to develop sales in the North of Britain for the Canadian manufacturers of Moffat electric cookers, eventually becoming sales manager for that firm in 1938. Upon the closing down of their English branch by Moffats Ltd, Mr Coppock was appointed by his present firm to inaugurate and develop their Service and Repairs Division which he will now continue to control.

The post of deputy station superintendent at Kirkstall power station, Yorkshire Division, B.E.A., is to be filled by **Mr J. Exley,** A.M.I.MECH.E., A.M.I.E.E., M.INST.F., with effect from 1 Aug. Mr Exley has held a similar position at the Division's Huddersfield power station since Jan. 1952. Earlier, he was operation engineer at Ferrybridge power station from 1949 to 1951, and shift charge engineer there from 1947 to 1949 after occupying a similar position for a year at the Stoke power station.

The appointment of eight of the nine members of the U.K. Atomic Energy Authority, which is to take over control of atomic energy development in this country as from 1 Aug., was announced last Thursday. The chairman is **Sir Edwin Plowden** (salary £8,500 p.a.), and the other full-time members are: **Sir John Cockcroft,** F.R.S., **Sir Christopher Hinton, Sir William Penney,** F.R.S., and **Sir Donald Perrott.** Part-time members will be **Lord Cherwell,** F.R.S., **Sir Luke Fawcett** and **Mr I. A. R. Stedeford.** Salaries of the full time members are £5,000 a year. Sir John Cockcroft, Sir Christopher Hinton and Sir William Penney are to receive an additional £1,000 a year in their capacity as executives of the Authority. The part-time members receive £500 a year, except for Lord Cherwell who, at his own request, will receive no payment. Sir Edwin Plowden has been the government's adviser on atomic energy organisation since the transfer of respon-

sibility from the Ministry of Supply. Lord Cherwell resigned from the post of Paymaster-General last year to resume his academic duties at Oxford as Professor of Experimental Philosophy, although it was stated at the time that his advice would be available on atomic energy questions. Sir John Cockcroft is director of the Atomic Energy Research Establishment at Harwell. Sir Luke Fawcett is general secretary of the Amalgamated Union of Building Trades Workers. Sir Christopher Hinton is managing director of the Industrial group, Department of Atomic Energy. Sir William Penney is the director of Atomic Weapons Research Department. Sir Donald Perrott is secretary of the Department of Atomic Energy, and Mr Stedeford is chairman and managing director of Tube Investments Ltd.

Miss G. L. Entwisle, A.M.I.E.E., one of the first women electrical engineers in this country, retired on 30 June, 1954, after 38½ years' service with Metropolitan-Vickers Electrical Co., Ltd. In 1915, when she joined the technical staff of M.-V. from Manchester University where she studied physics, she was the first woman to be so employed, and she later had the distinction of becoming the first woman student, then, graduate, and finally an associate member of the Institution of Electrical Engineers. In 1927 she broadcast on the subject of "Women in Industry." From 1941 to 1943 Miss Entwisle was President of the Women's Engineering Society, succeeding Dame (then Miss) Caroline Haslett in that office; during that period she helped to form the Manchester Branch of the Society. Miss Entwisle was an executive member of the Council of the Electrical Association for Women from its inception and became the first secretary of the Manchester Branch formed in 1926. On taking her leave Miss Entwisle received presentations (including an electric hair dryer) from her electrical engineer colleagues and friends and from the M.-V. Long Service Association.

Mr E. M. Johnson, chief engineer, Plant Dept, presents a gift to Miss Entwisle

Station engineer at the Bideford power station, South Western Division, B.E.A., since 1923, **Mr W. H. Whillock,** was recently the recipient of a presentation made from members of the staff of the North Devon group power stations, in recognition of his long service.

Mr R. E. P. Briebach and **Mr Michael Parkinson** have joined the board of F. and A. Parkinson Ltd. (a company in the Crompton Parkinson group). Mr Parkinson was recently appointed general manager of the Electric Motor Works of Crompton Parkinson Ltd., at Guiseley. Later he was co-opted to the board of executive directors of that company. Mr Briebach is general manager of the whole of the lamp and lighting fittings manufacturing sections of C.P. Ltd., and has been an executive director of the company since 1946. It is also announced that **Mr C. A. J. Martin,** G.C., M.C., B.A., A.M.I.E.E., M.INSTR.R., has been appointed an executive director of Crompton Parkinson Ltd. **Mr Bernard Moore** has relinquished his appointment as an executive director of that company. At the June meeting of the board he was presented by the chairman with a silver rose bowl and a cheque in connection with his retirement.

Mr J. Foster Veevers, M.I.E.E., M.I.P.E., M.I.I.A., managing director of Peto Scott Electrical Instruments Ltd., for the past 15 months, has severed all his connections with the company, we understand. Before joining Peto Scott last year, Mr Veevers was general manager of the Swindon Works of the Plessey Co., Ltd., for about nine months. Previously he was with the General Electric Co., Ltd., as manager of the Stockport works of Salford Electrical Instruments Ltd.

Honorary degrees of Doctor of Science of the University of Birmingham were conferred upon **Sir John Cockcroft,** director of the Harwell Atomic Research Establishment, and on **Sir Harold Roxbee Cox,** chief scientist to the Ministry of Fuel and Power, at a congregation of the University on Saturday last. At the same ceremony an honorary Doctor of Laws degree was conferred on **Mr Oliver Lyttleton,** Secretary of State for the Colonies, and formerly chairman of Associated Electrical Industries Ltd.

We are very pleased to hear that **Dame Caroline Haslett,** D.B.E., COMP.I.E.E., has recovered from her recent severe chill. To recover from the effects of extreme fatigue she is taking a rest during July and August. Meantime, Dame Caroline asks us to thank all her kind friends who have sent letters and flowers during her illness.

OBITUARY

Mr T. Lloyd, late chief electrical engineer at the Dowlais works of Guest, Keen and Nettlefolds Ltd, died on 30 June, aged 87.

Sir Geoffrey Duke Burton, chairman of Blaw Knox Ltd., and of other concerns, died last week, aged 61. He was managing director of Birmingham Small Arms Ltd., from 1934 to 1944.

Sir Maurice George Simpson, C.S.I., M.I.E.E., who died on 2 July, aged 89, was director-in-chief of the Indo-European Telegraph Department, India Office, from 1923 until 1931, when he retired. He went from Coopers Hill Engineering College to the Indian Telegraph Department in 1887, and by 1906 had become electrical engineer-in-chief.

Dr J. H. Dobson, D.S.O., D.ENG., D.SC., M.SC., M.I.E.E., chairman and managing director of Dowson and Dobson, Ltd., engineers of Johannesburg, died on 29 June, aged 75. Born in England, he went to South Africa in 1904 and in the following year became Professor of Electrical Engineering at Transvaal University College, Johannesburg (now the Witwatersrand University). He was appointed city electrical engineer of Johannesburg in 1909, and subsequently, up to the end of 1919, was general manager and chief engineer of the Johannesburg Municipal Gas and Electric Supply and Tramways Department. He joined the firm of Dowson and Dobson Ltd. in 1920.

Mr J. Mirrey, B.SC., M.I.E.E., who died on 26 June, aged 70, was formerly manager of the drawing office of A. Reyrolle and Co. Ltd. He joined that company in 1912 as a senior draughtsman and gained rapid promotion to chief designer and finally became manager of the drawing office, from which post he retired in 1948. During that period he took a leading part in the development of metalclad switchgear and protective systems.

Mr William H. Fellingham who founded the Brighton heating and electrical concern of W. H. Fellingham Bros. Ltd, in 1898, died recently, aged 78.

Mr James Mountjoy Elliott, A.M.I.E.E., died on 3 July, aged 86.

Mr T. C. Hunter, M.B.E., ASSOC.I.E.E., who died on 1 July, joined the Fife Electric Power Co. Ltd. in 1911. After a period in Wemyss, he returned to Dunfermline. He subsequently held various posts, being assistant district engineer in the Western area until 1938, when he was put in charge of the Eastern area of the county, holding the position of district engineer at the time of his death. Since 1933 Mr Hunter served continuously on the Scottish Divisional Council of the E.P.E.A., in the capacities of hon. secretary, twice as chairman and twice as vice-chairman.

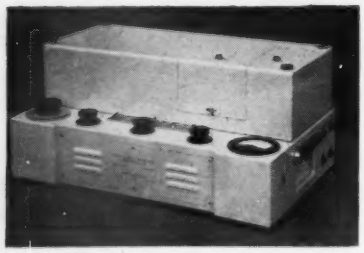
Mr Paul Karklinnis, of Epsom, importer of electrical accessories, died on 4 July.

Equipment for Industry

Instrument for Infra-red Analysis

DURING the last few decades infra-red rays have become an important analytical tool in industry, particularly for chemical products. Instruments developed so far have employed somewhat costly components and expensive techniques, but recently, the work of Sir Thomas Merton has enabled diffraction gratings to be produced by the National Physical Laboratory at a comparatively low cost. Using these gratings, MERVYN INSTRUMENTS, Copse Road, St. John's, Woking, Surrey, have now produced an infra-red spectrometer capable of being applied in a wide field of industrial analysis.

As a source of infra-red radiation, the spectrometer employs a Nernst filament, the light output of which is interrupted 800 times a second. Light from the filament is directed to the monochromator, a Merton-N.P.L. grating, which scans a frequency range of 2·8 to 3·8 microns, (28,000 to 38,000 Angstrom units), whilst a filter absorbs unwanted orders. The



The Mervyn-N.P.L. Spectrometer is a valuable tool for infra-red analysis

resulting infra-red rays are then detected by a lead selenide cell, the output of which is amplified and may be recorded or used to operate a controlling device. Moreover, the light output from the source is continuously monitored through the detector, the gain of the amplifier being adjusted automatically so that variations in source output, or detector sensitivity and amplifier drift are overcome. This feature is of considerable importance in view of the emphasis now given to quantitative measurements of absorption, quite apart from reliability for automatic process control. Automatic correction of the responses of the amplifier, filter and detector to radiation at different frequencies is also incorporated by means of a continuously adjustable cam. It may, if desired, be set to allow for any non-linear absorption in the cell. The sample compartment may be adapted to take most kinds of absorption cell, with which users may be familiar, whilst any normal type of cell may be supplied.

Main control of the spectrometer is a dial calibrated directly in wavelengths, which may be operated manually, set at a fixed point or rotated by a synchronous motor. In the latter method, a continuous scan is obtained which is unidirectional, and to reduce ambiguity therefore the output is reduced to zero during flyback. Output is presented on an indicating instrument calibrated in percentage transmission, whilst, as stated previously, provision is made for a recording instrument to be connected. Apart from three additional controls for bandwidth meter zeroing and fine output control, the only other control provides variation of the light attenuator in the light reference path to provide large gain changes required for abnormally opaque samples. Facilities are provided for evacuating the monochomator or filling it with a suitable gas. It operates from a 200 to 250 V supply, 40 to 60 c/s.

Testing Insulating Oil on Site

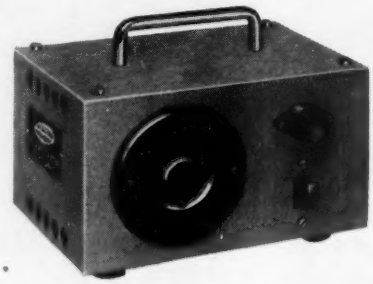
WHERE it is required to test transformer or switch oil on site, the portable test equipment now available from EVERETT EDGCUMBE and Co., Ltd, Colindale Works, London N.W.9, provides a suitable means of speedily carrying out this operation, and weighing 100 lb, in a case 16 in. by 15 in. by 12 in., is readily transportable. Housed in the case are the two units comprising the tester, test unit and control unit, of which the latter contains a "Variac" variable output auto-transformer and a 4 in. sq. flush pattern voltmeter indicating from 0 to 50 kV.

The test unit houses the v.t., contained in a compound-filled enclosure and, operating from a standard medium voltage supply, designed to provide up to 50 kV, with ample capacity to ensure complete breakdown of the oil. The transformer has a good regulation, and a peak factor stated to be only 3% different from that of a sine wave. On top of the transformer unit is mounted the test cell which may be one of two patterns, the preferred type having an insulated top cover through which the electrodes project. Electrodes in both patterns conform to recommendations in B.S. 148, and the gap is normally 4 mm.

Control of the primary voltage is effected from a d.p. press switch, guarding against the possibility of the operator inadvertently leaving the supply connected whilst making adjustments on the test unit. An s.p. circuit-breaker is also fitted in the transformer primary, tripping when oil breakdown occurs, whilst a shield red warning lamp gives indication that the control unit is connected to the supply. As control and test units are detachable, remote operation is facilitated.

Earth Conductor Tester

A SAFETY device for rapidly testing the efficiency of earth conductors on portable electric tools, the "Terra-Tertia" test unit provides a simple means of guarding against danger anywhere in the workshop. Manufactured by ELECTRO-METHODS LTD., Caxton Way, Stevenage, Herts, the test unit is housed in a robust case, 8 in. by 7 in. by 6½ in., weighing 12¼ lb, and is connected to a standard 220/250 V, 50 c/s a.c. supply. The tool under test is plugged into the 15 A, three pin socket outlet mounted on the front panel, and, with the body of the tool in electrical contact with the carrying handle, the panel switch is then depressed. A high current at low voltage flows through the earth conductor and associated plug. If the conductor is satisfactory it withstands the flow, and the "pass" lamp on the front panel lights up. Should,



With the "Terra-Tertia" unit it is simple to detect faults in earth connections

however, the earthing system be faulty, the lamp will not light, an indicating system which also ensures that a faulty tool will not be passed due to a lamp failure. In cases, where the earth conductor is partially fractured due to negligence or wear and tear, the test current is sufficient to burn out the strands of the conductor anticipating later failure.

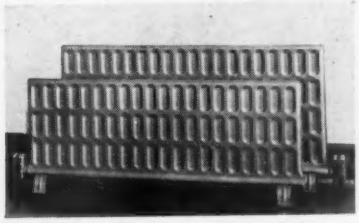
Germanium Junction Components

AS a result of extensive research and development undertaken by the Rectifier Division of STANDARD TELEPHONES AND CABLES LTD., Warwick Rd, Boreham Wood, Herts, there is now available a range of germanium junction power rectifiers and photo-electric cells. The latter consist of p-n junctions which, if suitably biased in the reverse direction, pass a saturation current largely insensible to variations in the applied voltage. When the junction is illuminated the current increases in proportion to the light energy. They are not suitable for photographic work. Germanium rectifiers are also of the p-n junction type, having a maximum input voltage of 100 V (r.m.s.) and mean d.c. output current of 100 mA into a resistive load and 75 mA into a capacitive load.

Dimplex Heaters Altered

NEW two kilowatt heater E. 420 has been announced by DIMPLEX LTD., Totton, Southampton, Hants., to replace existing model E 424, and the 1½ kW model D320 has been produced in one piece.

All Dimplex models will now be available in pink whilst the black finish has been withdrawn. In addition the 1½ and 2 kW column type models have been supplied with interchangeable feet or castor wheels.



The D320 model stands in front of the new E420 heater

New G.E.C. 8 cu ft Refrigerator

LATEST addition to the G.E.C. refrigerator range is model D.E.81, an 8-1 cu ft model with many de luxe features.

Included in these are the plain bowed door with storage racks including an egg and fruit rack; a full width freezer in stainless steel with spring loaded drop down door holding 40 lbs. frozen food; an ice cube tray and storage shelf, quick chiller drawer in "dawn-light" tinted translucent plastic occupying the full width of the refrigerator and situated below freezer; a main food compartment with two translucent plastic butter dishes and saladors, and specially designed shelf apertures to accommodate the necks of tall bottles to ensure that no shelf space is lost when storing these.

An eye level thermostat provides ten temperature settings including one "extra cold." Easy to read moulded name strips mark the right places for storing various foods. A locking door handle and interior light are provided in this chest-high refrigerator which costs 138 guineas inclusive of purchase tax and installation charge.

The door racks, full width freezer and quick chiller are features of the DE81 refrigerator

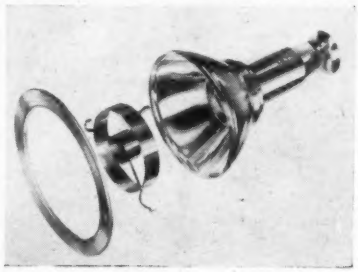
Concurrent with the introduction of this model G.E.C. have produced an attractive 122 page book " Artistry in cold food preparation with notes on care of your refrigerator." This publication DE2334 is listed at 5s. but is being issued free to each purchaser of all new models.

Shop Window "Spot" by Siemens

DESIGNED specially for shop window lighting, the F. 7705 new fitting announced by SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD, 38-39 Upper Thames St, E.C.4, is constructed of heavy gauge aluminium and comprises a ventilated gallery and reflector.

This reflector, by reason of a special anodic process permanently retains a high reflective quality. The fitting is provided with a focusing device for producing a spotlight or general flood, adjustable mounting being achieved by means of a stirrup bracket assembly.

Also available as extras are a matt black finished circular louvre, equipped with spring clips for easy fitting, and a soffitt ring to allow recessing of the fitting into a false ceiling.



The soffitt ring and louvre are useful extras for the F7705

For use with a 100 W or 150 W tungsten filament lamp and provided with a b.c. skirted lampholder, the fitting is priced 39s. 6d. with optional extras at 9s. for the louvre and 8s. 6d. for the soffitt ring.

Heat and Light Therapy

TO provide the equivalent of the sun's rays at times and places where it is most urgently required is the task of the medical "sun ray" lamp. Two such models which are most efficient sources of these heating rays are the Cardinal "Coronation" and "Junior" models, which are supplied by ULTRA-VIOLET LTD., 47 Avenue Chambers, Vernon Place, W.C.1.

Either the Cardinal short-wave infra-red ray lamp with Edison screw fitting for 300 W output on 200/250 V supplies or the old type long way infra-red emittor are available together with the Neron Ultra Vitalux irradiator lamp (see ELECTRICAL TIMES, 17 May, 1951).

The "Coronation" model has been designed primarily for the short-wave infra-red bulb and is a simple yet study construction with anodised reflector, cream base and chromium fittings which with the short-wave infra-red No. 101 and the Neron Ultra Vitalux irradiator costs £11. 17s.

The "Junior" model is an economical stand just introduced for use with any of the reflector lamps. It is strongly made of steel, stove enamelled in cream, with other parts chromium plated. Complete with 8 ft twin flex and 2-pin 5 amp plug the "Junior" model costs £1. 19s. 2d. whilst with a 300 W infra-red reflector bulb it costs £3. 4s. 2d. (tax paid) or with the Neron Ultra Vitalux irradiator (German Osram) it costs £7. 18s. 8d.

A medical certificate is required in some cases and readers should check with the makers.

For the Electrical Trade

Sanders 13 Amp Fused Rubber Plug

THE attention of our readers is drawn to an advertisement which appeared in our 24 June issue.

In this advertisement by WM. SANDERS AND CO. (WEDNESBURY) LTD., Wednesbury, Staffs, the price of their new 13 amp fused plugs in resilient rubber was quoted, due to an unfortunate printing mishap, as 8s. 3d. each retail. This, of course, is quite wrong, the plug will retail at the competitive price of 3s. 8d.

Trade Publications

VACUUM EQUIPMENT.—Oil and mercury pumps, the palladium barrel leak detection gauge model 1 and model 3 ionisation gauge heads and control units, new vacuum switch, thermo plastic moulding with the aid of vacuum; and vacuum coating accessories are subjects of six new publications by W. Edwards and Co. (London) Ltd., Manor Royal, Crawley, Sussex.

TRANSFORMERS.—A six-page brochure describes a new range of transformers specially designed for the electronics industry by Radford Electronics Ltd., 129 Newfoundland Rd, Bristol 2.

CONSUMERS UNITS.—Leaflet No. 107/54 released by Siemens Electric Lamps and Supplies Ltd., 38-39 Upper Thames St. E.C.4, deals with the Siemens new type consumer service unit both metalclad and insulated patterns.

NEWS OF THE WEEK

U.S. Firm Enters Domestic Market

Factory will supply U.S. Forces and U.K. Retailers

ANOTHER American firm has established a subsidiary in Scotland. This is not a unique event but it has significance this time because the company concerned is an electrical one. Sunbeam Electric Ltd. has been formed with a registered capital of £350,000 and plans to set up a factory in East Kilbride. It will be about 200,000 sq ft in area, but land has been reserved for a further extension of 375,000 sq ft should the market conditions justify expansion. Moreover, the Board of Trade has arranged for the leasing of a small temporary factory at Hillington which will probably be in production within two months. Employment will be provided at the new town for about 2,100, the majority of whom will be women. This new British subsidiary is, of course, an offshoot of the Sunbeam Corporation of Chicago, manufacturers of a number of smaller domestic electrical appliances such as toasters, irons, mixers and coffee makers. The Sunbeam Corporation already has subsidiaries in Canada and Australia, and it is primarily intended that the new British concern will take over at least part of the market in this country served by the parent concern. The Chicago company at present supplies the American Forces in the U.K. and Europe. It is also hoped that they will be able eventually to sell their products in the commercial market.

The establishment of this new factory will have two main results. First and foremost it will be earning this country more dollars by selling goods to the U.S. servicemen in this part of the world. As production expands Sunbeam appliances will undoubtedly be launched into the commercial market, thus providing some added competition. At present American goods can only find their way into this country under the token import scheme, which limits the amount despatched to 30% of pre-war imports. The scheme was intended merely to enable American makers to keep their name before the British public, but the licence is not transferable from one commodity to another. Thus the amount of U.S. goods on the British market is very small indeed.

Managing director of Sunbeam Electric is Mr E. S. Northup. This new company is one of the largest prospects attracted to Scotland under the Distribution of Industries Act.

International Meeting on Pure and Applied Physics

TAKING place during the latter part of this week at the Royal Society's rooms in Burlington House, London, is the eighth General Assembly of the International Union of Pure and Applied Physics. Proceedings opened yesterday and close on Saturday. In addition to private meetings and discussions on scientific matters of international significance, three papers are scheduled. Tomorrow, Prof E. Amaldi is to present his paper on The European Organisation for Nuclear Research, and held over until Monday is Prof C. Kittel's Microwave Experiments in the Physics of Solids. Yesterday, Fields and Particles was read by Prof J. A. Wheeler.

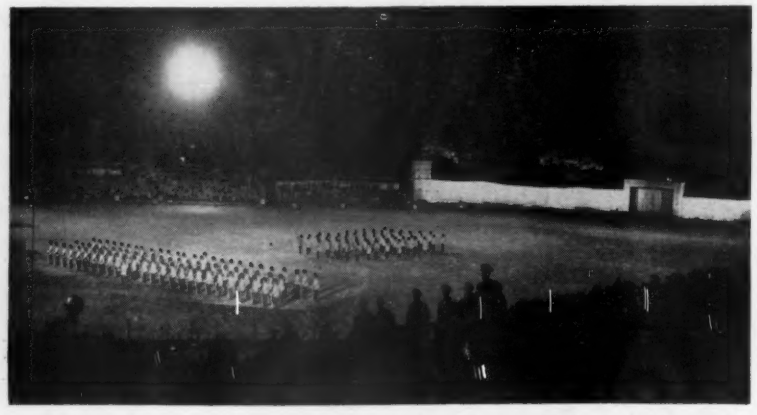
More Consumers to Pay Bills Fortnightly

FORTNIGHTLY payments of electricity bills in the N.E. Electricity Board's area appears to be a successful procedure. Under the system the Board collects payments at short and regular intervals of two weeks, and it will be recalled that a rough calculation made last April showed that some 52,000 consumers were involved. As reported in our 15 April issue, the Board extended the scheme to local housing estates lying mostly in the Wear sub-area, but we learn now that plans are in hand to expand it to the Blyth area which is in the Tyne sub-area. Over 3,500 consumers have been circularised to see if they are in favour of the scheme. Customers pay a fixed annual sum in fortnightly instalments and if more or less electricity is consumed the balance is made good at the end of the year.

I.E.C. Jubilee Plans

ARRANGEMENTS are now being completed for the Golden Jubilee celebrations of the International Electrotechnical Commission, which are to be held in conjunction with a series of Technical Committee meetings in Philadelphia, U.S.A., from 1 to 16 Sept. The Commission was founded in the U.S.A., at the International Electrical Congress held in St. Louis in 1904. Lord Kelvin was the first president. The official celebrations will be held on 9 Sept., under the presidency of Dr H. S. Osborne (U.S.A.). Chief British delegate will be Lord Waverley, Past President of the British Standards Institution.

Normally, annual I.E.C. meetings comprise a series of about twelve technical committees, but on this occasion, nearly fifty committees and sub-committees will be in session. The British delegation will total about ninety, all appointed by the British National Committee.



Roundhay Park, Leeds, the scene of the Northern Command Tattoo held recently. The impressive display was illuminated by 72 floodlights supplied by the General Electric Co. and used extensively at football grounds. The lamps were mounted on 90 ft tubular scaffolding towers. There were three towers each carrying 24 floodlights housing 1,500 W angle burning and 1,000 W class B.1 projector lamps. The wall was illuminated by 48 floodlights for small offset with 1,000 W B.I. projector lamps.

More Households with Electricity and TV Sets

ONCE again the annual Hulton Readership Survey provides some interesting figures on the number of households using gas and electricity. The survey is primarily concerned of course with the reading habits of various categories of people, and has been based on interviews with just over 13,000 persons made during the first three months of this year.

Of most significance is the remarkable increase in the number of householders with electricity. That figure shows a rise of some 400,000 over last year's figure, while there was no noticeable difference in the number of homes with gas. Total numbers with electricity and gas at present are 14,400,000, and 12,200,000 respectively.

AVAILABILITY OF GAS AND ELECTRICITY

Classes:	AB	C	DE	All
	%	%	%	%
With gas and electricity	77	75	69	71
With electricity only	22	22	20	21
With gas only ...	—	2	9	7
With neither	1	1	2	1
Total with electricity	99	97	89	92
Total with gas ...	77	77	78	78

Class AB: well-to-do and middle; Class C: lower middle; Class DE: working and poor.

Comparing figures in this table with those of last year, it is evident that a considerable number of householders have switched to electricity. Households with electricity have increased in number in all classes, whilst those with gas have decreased except in class DE. Households with gas only have also decreased, and at the same time those with electricity only have increased in all classes except DE.

For the second year, the Survey also deals with the reading habits of television viewers. Explanatory notes in this section show clearly the impact of the Coronation. In last year's survey the TV audience was estimated to be 5,920,000 adults, but this year the figure is put at 9,190,000 adults, or an increase of 55%.

POSSESSION OF TV SET IN THE HOME

	% of total adult pop.		% of total adult pop.
All adults ...	25·2	Age	—
Men... ...	26·0	16–24	22·5
Women ...	24·5	25–34	24·8
Class A ...	46·7	35–44	31·5
Class B ...	40·5	45–64	26·5
Class C ...	33·7	65–	15·3
Class DE ...	20·4	—	—

The increase has taken place in all classes of the population and in all age-groups. Most remarkable rise appears to be in class C where last year's figure was 20·2, whilst in the age groups the biggest increase is in the 35-44 group where the 1953 percentage was 20.

ATOMIC ELECTRICITY AT PENNY PER UNIT

EVEN on the most pessimistic estimates, Britain would soon be producing electricity by atomic power at 1d per unit, Sir John Cockcroft told the Scientific Committee of the French Chamber of Deputies in Paris last Thursday. The two nuclear power units in Cumberland, he said, would be economic because they would produce plutonium as a by-product. The cost of nuclear power would be 30% higher than that from coal if one considered the most pessimistic estimates.

Other types of units were being considered with the object of cutting capital and fuel costs. Sir John said that if they took as an objective the building of nuclear power stations developing 5,000 MW, it would mean about three years' construction at present levels of increase of generating plant. He envisaged a development period of about eight years to develop and operate the first two British power stations, and then to build and operate improved versions. Later it should be possible to build the 5,000 MW of nuclear power, which could be achieved between 1965 and 1970.

ANOTHER DOLLAR ORDER

FURTHER evidence of British manufacturers' success in dollar markets is the announcement on Tuesday of the securing of a substantial order for mobile ground power units by Auto Diesels Ltd. and Crompton Parkinson Ltd. Value of the contract which was placed by U.S. Government is over $1½ million. The units will be for the use of Allied Powers. It is understood that the contract was obtained in the face of keen competition from six continental countries, namely, Sweden, France, Italy, Switzerland, Belgium and Germany.

It will be recalled that a similar large order for these units was placed with Crompton Parkinson by B.O.A.C. nearly a year ago. They were for use at a number of points between London and Rome.

ROCKET USED TO STRING CABLE ACROSS NILE

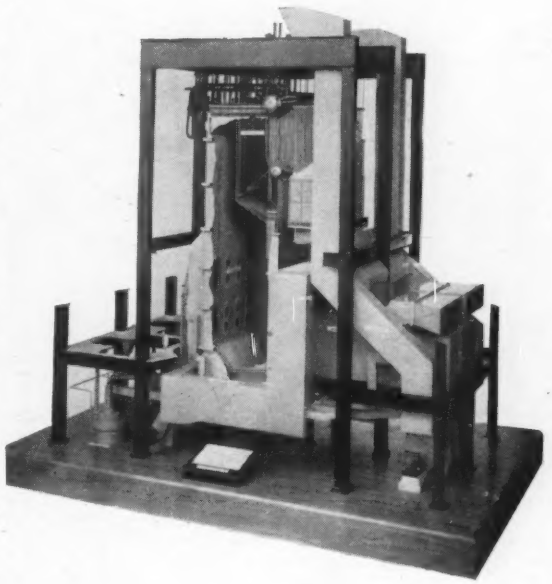
CROSSING the Nile is a difficult and hazardous operation even without encumbrances, but the task of carrying the Uganda Electricity Board's 132 kV overhead transmission line from Owen Falls power station to Tororo, presented added difficulties. To establish a line of communication over the crocodile-infested rapids the contractors, British Insulated Callender's Construction Co. Ltd. borrowed a Schermuly rocket apparatus from the Port Authorities at Mombasa. A light line was first fired across the river, and then used to draw over a ½ in. diameter manila/sisal compound rope. This was made fast to convenient trees on both banks. It has since been replaced by a stranded steel draw wire which will later be used to pull the steel cored aluminium cable across. The company has previously employed standard coastguard rocket-firing equipment for such crossings but not the Schermuly apparatus.

OFFICIAL PUBLICATIONS

BRITISH STANDARDS. B.S. 2455, 1954: Methods of Sampling and Testing Boiler Water Deposits; B.S. 2486, 1954; Treatment of Water for Land Boilers.

Water Heater Sales Up

PUBLICITY campaign begun last April to boost the Eastern Electricity Board's sales of water heaters has paid dividends. Sales of these appliances during April and May were 3½ times those of the same period last year. Advertising media includes a double crown poster, 16-sheet poster, Press advertising in 120 local papers and a leaflet, distributed through Service Centres and in response to enquiries.



An interesting feature of the Babcock and Wilcox boilers at the Taaibos power station of the Electricity Supply Commission of South Africa, described in the ELECTRICAL TIMES *last week, is the arrangement of the pulverised fuel system. As can be seen in the accompanying illustration of a model of one of the boilers, four E type mills are each connected to a horizontal line of four burners so as to ensure an even flame distribution with one or more mills out of operation. The boilers are of the bi-drum type, rated at 580 klb/hr m.c.r.*

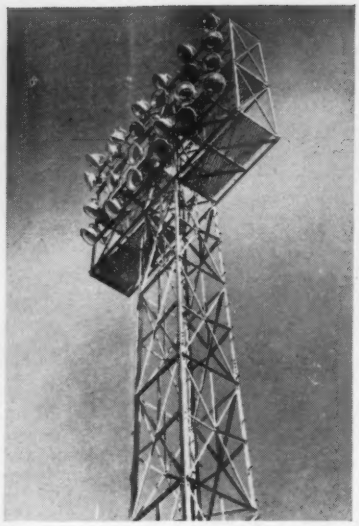
ATLANTIC SUBMARINE CABLE CONTRACT

A FURTHER order in respect of the transatlantic telephone cable project has been placed with Submarine Cables, we hear. This latest contract concerns the second complementary cable from Oban to Newfoundland, and the single underwater cable between Newfoundland and Nova Scotia. An order for nearly 90% of the first of the two cables was placed with the company last March. Total value of the contracts will amount to some £5 milions now. Submarine Cables is owned jointly by Siemens Bros. and Telegraph Construction and Maintenance Co.

School on Aircraft Electrical Systems

THE electrical engineering department of the Imperial College of Science and Technology is to hold a five-day vacation school to review aircraft electrical systems. Object of the school is to bring out the scientific principles underlying the design and application of all equipment in aircraft electrical systems, and is intended primarily for engineers with some experience of the subject and who could therefore contribute to discussions. Fee for the school (including lunches, transport, etc.) will be £8. 8s., and it will take place from 20 to 24 Sept.

The programme for the five days is formidable and the list of speeches impressive. Subjects on the agenda include power systems, brushwear and vibration, cooling, a.c. and d.c. machines, switchgear, system operation and protection, and electrical installation engineering. Fuller details may be had from Mr B. Adkins, City and Guilds College, Exhibition Rd, S. Kensington, S.W.7.



One of the two larger banks of floodlights erected at one of the Lagunillas sports grounds of Compania Shell de Venezuela

PACKAGING AGM

PACKAGING is an incidental but by no means unimportant consideration of the electrical industry. We note therefore the 24th annual meeting and exhibition of the Printing, Packaging and Allied Trades Research Association, held in London last week. Emphasis was laid on the need for making packages for U.K. goods sold abroad as attractive as artistic ingenuity could achieve. Not only must goods arrive safely at their destinations but they should be attractively covered to sell against their foreign counterparts, the meeting was told. We hear that the Association's research laboratories at Leatherhead are progressing rapidly.

Floodlit Sports Arenas in Tropical Countries

ALTHOUGH the floodlighting of sports arenas has been recognised as a valuable asset in this country, there are other localities in the world in which it is even more valuable. In tropical countries the playing of ball games becomes an arduous task in the mid-day heat and not the relaxation and pleasure intended. Play the game in the evening when it is cooler and one finds there is but an hour or less of twilight. Hence the advisability, if not the necessity, of floodlighting, and Compania Shell de Venezuela Ltd. have made great efforts to solve the difficulty.

One of the places with no twilight is Lagunillas. There, eight self-supporting galvanised lattice-steel towers 75 ft high, designed and supplied by the British Insulated Callender's Construction Co. Ltd., each supporting a bank of Revo Electric Co. Ltd.'s floodlight units, have been used to illuminate each field. Each floodlight unit has a 1,500 W lamp and six of the towers carry 12 lamps and the other two 24 lamps. The results have proved most satisfactory and have greatly improved the recreation time of local employees of the company.

Lighter Side of Trade with U.S.S.R.

TRADE negotiations with the Russians provided the subject for the after-luncheon talk to the Batti-Wallahs' Society at their June meeting last week. The speaker was Mr J. B. Scott, D.F.C., a member of the Society, who headed a trade mission to Moscow recently. As was appropriate to the occasion, he confined his story to the lighter side of this experience, and to some of the character-revealing sidelights of the trip. He did point out, however, that often machinery in Russian factories seemed well out of date by Western European standards, and that Russian engineers realised this and were anxious to bring their equipment up to date. An exception was the Moscow cable works.

One of two winners of British National Electrics Ltd.'s Ideal Home Competition was presented with their prizes at Sheerness recently. Pictured here are Mr and Mrs Hales with members of the S.E. Electricity Board, and the prizes, a C.49 cooker, a 3-gall. storage water heater, and an F.103 fire. It will be recalled that there were two prize-winners, and although the rules stipulated the value of the prizes should be divided equally in such a case, it was decided to give each the complete prize. Messrs Sanders and Ring of B.N.E. are standing behind the cooker. Mr Sanders also presented Mrs Townsend of Dorchester, Oxford, with her award

The First Half-Century

The ninth annual Convention of the Incorporated Municipal Electrical Association was opened at Derby on 29 June, Mr T. P. Wilmshurst presiding, continued at Nottingham on the following day, and at Sheffield on Friday, returning to Derby for the business meeting of the Association on 2 July. The Council were, of course, at Derby, the official place of meeting; the majority of those attending lodged at Nottingham, where the annual dinner was held. The programme of proceedings provided for the discussion of six papers, two on each day. On former occasions the Association has endeavoured to deal with three or more papers. There can be no doubt that the arrangement this year has resulted in more satisfactory discussions.—*From our issue of 7 July*, 1904.

Immediate and Assured Market in S. America

JUST back from a three-month tour of Central and S. America and the Caribbean area, is Sir George Nelson, chairman of the English Electric Group of Companies. Main purpose of his mission was to discover how British industry in general and the electrical industry in particular, could contribute to the needs of the countries he visited, and at the same time, to find out how Britain could help them obtain goods they required to develop their individual and our joint economies. The tour was sponsored by the Treasury, Board of Trade, Ministry of Materials, Foreign Office and the F.B.I.

One major consequence of the many talks Sir George had on his travels is likely to be a greater participation by U.K. industry in plans for capital development. He was greatly impressed by the vast potential natural resources of the countries through which he passed, and given the best opportunities for developing those resources, he maintains a major contribution could be made to the expansion of world economy and trade.

It was important, however, that British representatives should not only be highly qualified technically, but also skilful salesmen with a sound knowledge of Spanish and Portuguese languages. Otherwise there appeared to be no reason why British goods should not have an immediate and assured market on an increasing scale in the area. Much has been written and said about our delivery dates, mostly critical, but these have been rapidly improving. Sir George found, however, that that marked improvement was not fully realised.

Consultative Councils discuss Uniforms, H.P. Hire and Tariffs

A VARIETY of subjects were discussed at recent meetings of Consultative Councils. Not alone in their feelings of concern of reports of persons pretending to be employees of the Board, the E. Midlands Council have been informed that every member of the Board's staff will in future be issued with an identity card which he will have to present when seeking admission to consumers' premises. As an extra safeguard, all meter readers in the area are being given uniforms and peak caps bearing the initials EMEB.

Another matter which has occupied plenty of time at these and other meetings, is the question of hire purchase of washing machines. The E. Midlands chairman has now been instructed to press for the exclusion of these appliances from the Hire Purchase and Credit Sale Agreements Order 1952. At present this method of purchase requires an initial payment of one-third the total cost, with the balance payable within 18 months. A relaxation of this Order has been the subject of Parliamentary questions recently.

The S.W. Scotland Council have welcomed their Board's introduction of a hire scheme for immersion and water heaters. Hire charges in that area, including plumber work, lagging and maintenance are 6s. 6d. a quarter for immersion heaters and 9s. 6d. for self-contained water heaters, with extra charges for certain incidental work.

A letter from the Board's chairman to the Eastern Council gives an assurance that the existing tariff structure will remain unaltered until 1 April next. The letter states that increases in costs have surpassed the price of electricity but stabilisation has been made in the interests of the national economy and in an effort to keep down the level of living costs. Popular belief was that the letter was a subtle form of warning.

CONTRACTORS REGISTER

ANNUAL meeting of the National Register of Electrical Installation Contractors took place in London on Monday. Mr E. A. Mills took the chair in the absence of Mr P. V. Hunter, whom, we note, is now in his thirtieth year as chairman of the Register. Accounts submitted at the meeting showed that total expenditure during 1953 exceeded income by £183. At the close of last year the total number on the Register was 879 compared with 903 at the end of 1952.

SALES OF CLOCKS UP

NOW that power-cuts are almost a thing of the past, the popularity of electric clocks has increased. Whilst the possibility of cuts in electricity supplies existed, the public adopted a wary attitude towards the electric clock, preferring the older clockwork models independent of outside influence. In a report issued by B.E.A.M.A. it is stated that sales of electric clocks for this year were 60% up on last year and 75% up on 1951-52.

Science Museum stages Parsons Exhibition

THE centenary of the birth of Sir Charles A. Parsons is being commemorated at the Science Museum at S. Kensington. A special display will be on view in the East Hall for about three months. It will be open every day and admission is free. Among exhibits is Sir Charles' original 7½ kW high-speed steam turbo-generator of 1884 which is adjacent to a scale model of a modern Parsons 50,000 kV steam turbo-alternator. Both these exhibits incidentally occupy the same amount of space. Photographs show other developments which followed the pioneer's researches and inventions.

Mr A. W. Browne, chairman (right) and Mr H. V. Schofield, director of Chloride Batteries Ltd., arriving in style at the Pavilion, Bournemouth, for the Exide Convention Banquet on 24 June. The vehicle is an 1898 battery-driven electric Krieger Brougham, and has been adopted as the company's new mascot. (Photo "Bournemouth Daily Echo")

NEWS IN BRIEF

Indian import policy for the second half of 1954 includes the liberalisation of imports of some 60 items and a scaling down of quotas for 35 items now made in the country. Under the first decision fall such items as instruments, compressors, and motor car lamps . Quotas scaled down include those for fluorescent lamps.

As a result of the Electron Players' performance at the Crane Theatre, Liverpool, on behalf of the Merseyside and N. Wales branch of E.I.B.A., a sum of £70 has been contributed to the Association's funds.

Netherlands Railways have placed an order for pumpless steel-tank rectifiers with the General Electric Co. Ltd. It involves 13 twin-cylinder units each rated at 1,224 kW and includes electronic arc-suppression equipment.

There were about 80 exhibits at the annual flower show of Crompton Parkinson Ltd.

Annual challenge shield match between Midland Radio Industry Golfing Society and Lancs and Cheshire R.I.G.S. was won by the Midlanders thus avenging last year's defeat.

The author of the article "Solving Networks by Thevenin's Theorem," which appeared in last week's ELECTRICAL TIMES was Mr. S. A. Swann, and not as stated.

Earls Court has been chosen as the venue for the 1955 British Instrument Industries Exhibition to be held between 28 June and 9 July.

The Television Society has just published a "Bibliography of Colour Television." It is available from the Society price 2s. 6d.

QUESTIONS IN PARLIAMENT

Hire Purchase Order

RESCISSION of the Hire Purchase and Credit Sales Agreements (Control) Order, 1952, was suggested by Mr E. Fletcher last week. He maintained that it was not needed, that it had served its original purpose to conserve materials, and that it discriminated unfairly against the poorer people. Mr H. Strauss said the scope of the Order was being examined and the changes which had taken place would certainly be considered, but no statement could be made yet.

U.S. Dams Contracts

REPLYING to Mr D. Jay last week, Mr D. Heathcote Amory said that representations stressing the importance attached to the decisions made in the case of contracts for the Chief Joseph and Dalles dams had been made while the contracts were being considered by the U.S. Authorities. Following the award to U.S. firms instead of the British company, the U.K. Ambassador in Washington had been instructed to make representations at the highest level. He fully agreed that the price differential was substantial and the result extremely disappointing.

Nuclear Power

THE House received an assurance last week from Mr G. Lloyd that there was close co-operation between Government Departments, the B.E.A., the Atomic Energy Authority and manufacturers in all aspects of electricity generation, including nuclear energy generation. He reminded members whilst replying to questions by Mr Ellis Smith and Mr A Palmer, that the Atomic Energy Authority would only generate power as a by-product of the manufacture of fissile material or as a product of experimental power stations. It would not compete with electricity boards, but offer them any surplus remaining after their own requirements had been met.

Electricity in W. Indies

CRITICISM of the Demerara Electric Co. in British Guiana, was made by Mr D. Jones last week. He alleged dissatisfaction in the Colony over the company's failure to provide a plentiful supply of electricity, and asked if the opportunity might be taken in August, when the undertaking's activities were reviewed, to terminate the contract and establish a publicly-owned corporation to run the undertaking on a non-profit-making basis. In his reply, however, Mr O. Lyttelton said the company would have ample power to meet demand when extra plant was installed in October. In addition the company had been required to carry out certain improvements within the next three years, and provided they did so there was no power to end their franchise before 1977. In those circumstances, Mr Lyttelton said, further action was not considered necessary. The Demerara Electric Co. serves Georgetown and its suburbs.

Capital Allocation

A statement on capital allocation was sought by Mr Ellis Smith last week. He asked whether the Minister had been assured that capital would be available for the long term needs of all forms of power and fuel, and was told there seemed little doubt that those needs would be met. Mr Smith then asked if in view of the great contribution being made to the country's economic development by the N.C.B., B.E.A., and Gas Council, those organisations could have a long-term allocation so that they could plan a long time ahead. The Minister agreed saying there would be an opportunity to discuss the matter when the Borrowing Powers Bill came before the House shortly.

A.E.A. Appointments

A STATEMENT on the appointment of members of the Atomic Energy Authority was made in the House last Thursday. Eight members have been appointed and another one is expected to be named shortly. The act prescribes that the Authority should consist of between eight and 11 members. The appointments are reported on page 58.

District Heating

THREE new district heating schemes were being planned in conjunction with electric power developments, at Spondon, Warrington and Stepney, the Minister of Fuel and Power told Mr A. Palmer last week. He rejected a suggestion that special financial assistance should be provided beyond the resources of the electricity industry for the development of those schemes, adding that he thought it better for them to continue on the present basis of proper commercial negotiation.

Band III Television

ANSWERING questions on Band III television broadcasts, Mr D. Gammans explained that a number of radio manufacturers had carried out experimental and development work in that band, as well as the B.B.C. Tests had not been confined to specific channels. No such channels had been allocated to the B.B.C. on Band III as full coverage was catered for in Band I at present. As to the possibility of a second programme in Band III, Mr Gammans pointed out that it was not planned to start a second programme before 1957. In other replies to Mr Hobson, Mr Gammans said that if there was a second programme it would be broadcast in Band III necessitating the removal of land mobile services which would release two channels. Some other services might also have to be moved.

Saving Coal

STEPS being taken to save coal, improve its use and prevent air pollution, and also to reduce waste by industrial users were questions arising in the House following the Minister of Fuel's statement some days ago on the coal situation. The Minister stated that under the Government loan scheme 51 proposals had been approved amounting to £339,000. In addition substantial capital investment by the fuel industries had been approved to help save large tonnages of coal. Large savings were in fact being effected and the Fuel Efficiency Service was operating to advise industrialists.

Coal Supplies

SUPPLIES of coal to the domestic consumer was also raised. Mr G. Lloyd explained that the purpose of his previous comments in the House was to emphasize the danger that will arise in the winter if consumption continued to rise as at present and production remained static. Distributed stocks were higher than last year, but he strongly recommended summer stocking. He did not underestimate the gravity of the situation, and that was why the Government had decided to import more coal.

Oil Fuel

THE Minister of Fuel stated that substitution of oil fuel for coal was in the national interest and being encouraged by the Government. Use of oil had increased in recent years, and last year provided a coal equivalent saving of about 13 million tons compared with 10 million tons in 1950. The increase would probably continue and oil companies expected to be able to meet demands. He advised those considering larger or new uses of oil to discuss plans with prospective suppliers first.

Sayings OF THE WEEK

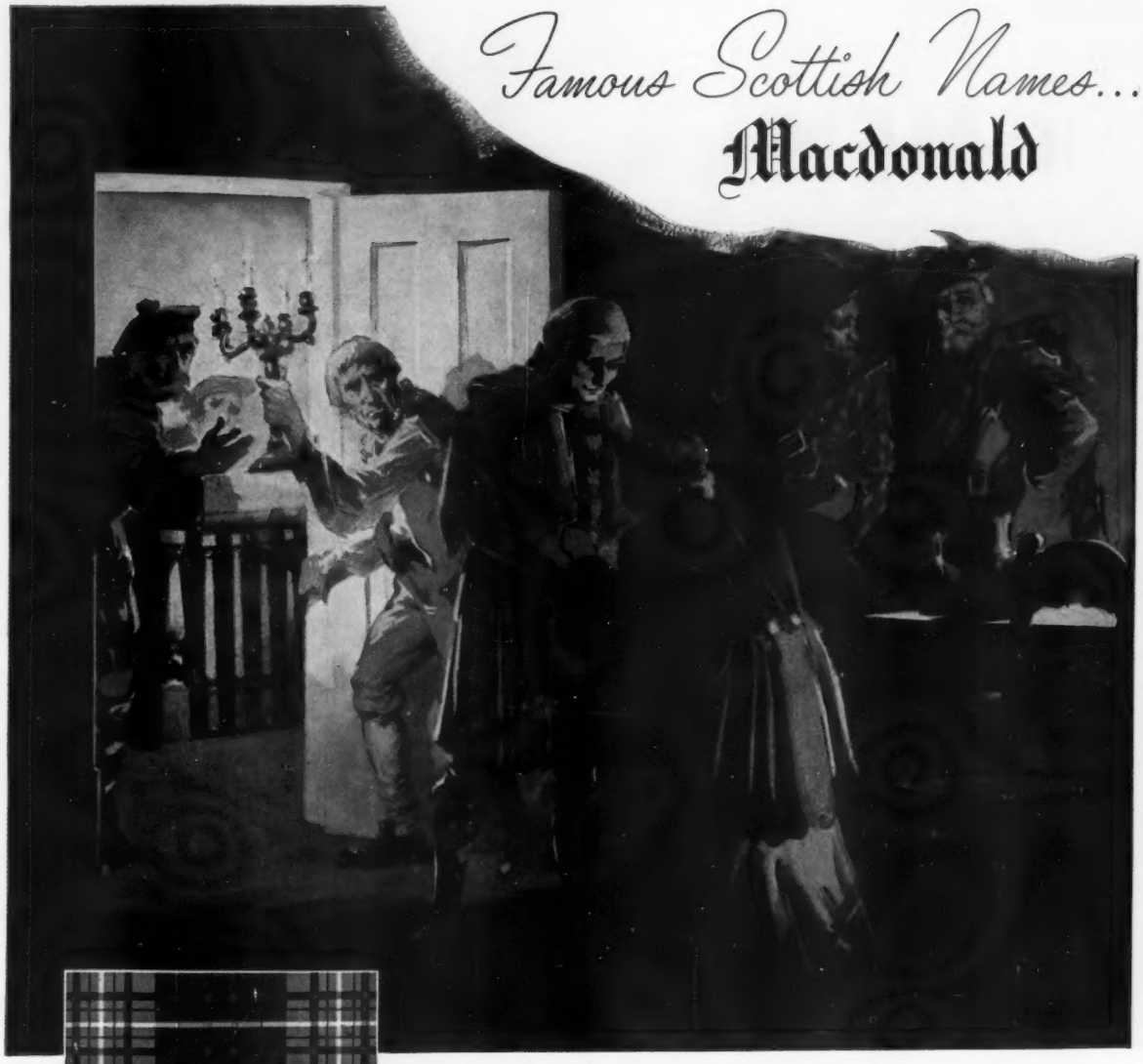
"There is no reason why one boy sitting in this room should not become the future chairman of the B.E.A." . . . MR J. ECCLES, deputy chairman (operation) addressing apprentices at Penarth.

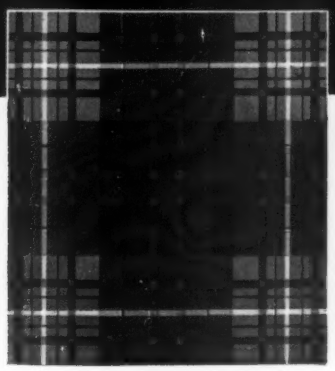
"The penetration of the refrigerator into the domestic market is only 8%. When one compares this with the demand for television and other such appliances one wonders why." . . . M. A. CRAIG, in *The Manchester Guardian.*

"Industry today is so bedevilled by politics that commonsense flies out of the window, and our whole economy appears to be governed by the expediency of the moment." . . . MR J. R. MIDDLETON, president of the National Association of Camshaft and Cylinder Grinders, speaking at its annual meeting.

Famous Scottish Names...

Macdonald





Countless stories are told of the adventures of Prince Charles from his defeat in 1745 at Culloden by the Duke of Cumberland. Most romantic of all, is the story of his farewell to Flora Macdonald at the inn at Portree on the Isle of Skye, to which she had brought him safely through many straits and desperate adventures. In her autobiography, Miss Macdonald writes, "The Prince came forward and taking both my hands clasped them warmly and said, 'Although my affairs are but gloomy and unfavourable, yet the time may come when I shall feel proud to welcome my kind protectress at St. James's. Farewell.'" The Macdonalds of Clanranald, with whom Flora was connected, are a branch of the Macdonalds, one of the oldest clans. Staunch supporters of the Stuart Kings, they served them loyally from the time of the famous Duke of Montrose until the issue was beyond all dispute. The Clanranalds were descended from John the 7th Lord of the Isles, a descendant of the famous Somerled.

Motto: "My hope is constant in thee"

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It's **MEM** again for top value in fires and convectors

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MEMRAY

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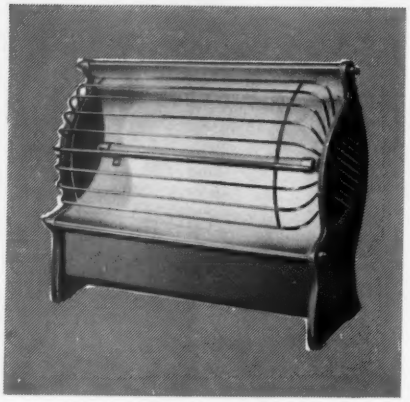
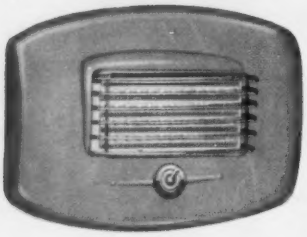


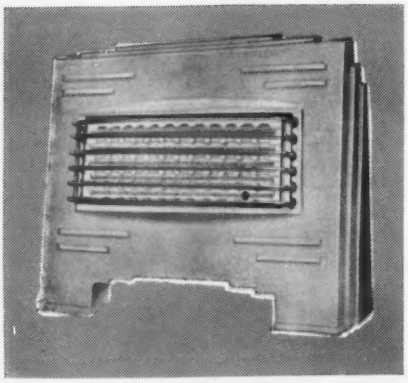
REFLEX

A sturdily built reflector fire offered at an attractive price. Cast iron sides, chromium plated brass reflector. In 1 and 2 kW ratings



PANEL FIRES

Attractive modern designs. The "Walbeam" Outset Flat Bar Pattern is designed for surface mounting. The "Walray" Inset Reflector Pattern is for recessing into wall or surround.



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A really well-made bar type fire that will give years of good service. Attractive simple design. Sturdy cast frame. In 1 and 2 kW ratings.

MEMVAIR CONVECTORS. Keep in step with the growing popularity of convectors by giving a prominent place in your showroom to MEMVAIR convectors. Handsome, efficient and absolutely safe. Lovely bronze finish. In three ratings, 1, 1½ and 2 kW with or without thermostat.

MEM [illegible]

COMPANY ACTIVITIES

Year to 31 Mar	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	339,748	136,716	47	15	16/9	11/5
1951	379,331	142,720	51	18	18/7	15/4
1952	464,737	158,546	58	20	17/–	13/3
1953	460,853	154,158	54	20	18/4	16/1
1954	504,225	167,767	58	25	21/9	16/10

IF any further indication were needed that the radio and TV industry is booming the Pye accounts for the year to last December are expressive. Untaxed group profits have risen sharply from £744,000 to £1,128,000. Tax charges have gone up even more sharply, from £508,000 to £868,000. That means that the net profit is up only from £236,000 to £260,000. The preliminary figures do not give the amount of excess profits levy which probably accounts for a considerable part of the heavier tax liability. That is something which will be missing next time, and even before allowing for that the latest earnings represent about 44% on the deferred capital and cover the 20% payment more than twice over. The dividend although at the same rate of 20% is really an increase of 6⅔% as there was a 50% scrip bonus last December.

Last week I commented on the 20,000-mile South American trip concluded by Sir George Nelson, the chairman of English Electric. It will not be plain sailing, trading with South American countries. Most of them, unfortunately, have tangled up their international currency arrangements to such an extent that it is almost impossible to remit profits, or dividends to the countries or companies overseas which earn them. Brazilian Traction Light and Power Co. is a case in point. Mr. Henry Borden, the President of that company, finds it necessary to announce at the annual meeting that he expects to pay dividends on a cash basis at least during 1954. He also said that the Bank of Brazil had made available exchange to cover the company's 1954 foreign currency needs for necessary imports into Brazil, both operating and capital.

It had also been given foreign exchange contracts in dollars which placed it in a position to pay the usual half-yearly dividend of 50 cents. The position is certainly easier for in February last Brazilian Traction paid its dividend in stock, amounting to 1/20th of an ordinary share with a cash dividend of only 3 cents (Canadian). Before Sir George Nelson's goodwill trip can be followed up to any great extent I should like to see a Treasury mission go out with representative bankers and other financial experts, with the object of cleaning up the manifold exchange difficulties of the major South American Republics.

Mr Thomas F. Lister, chairman of Hackbridge and Hewittic Electric Company, agrees that financial restrictions, notably in South America, "have closed markets where previously considerable business was obtained." In fact Mr Lister records that in the export market generally sales have become particularly difficult owing to import restrictions in some of the trade's traditional markets. Meantime, it is satisfactory to note that the Company's order book ensures full output in all divisions during the coming year. —*From our City Correspondent.*

Aiton and Co. Ltd.

For the year ended 31 Mar. last, the trading profit is £350,355 compared with £335,908 for the previous year. The net profit amounts to £119,005 (*£134,177*), the dividend being 17½%, as was foreshadowed when the Ordinary 10s. shares were placed at 25s. each last month.

Belliss and Morcom Ltd.

A final dividend of 8½% makes a total distribution of 11% for the year to 31 Mar. last—1½% less than in the previous year. The group profit, after tax, is £61,170 (*£62,272*).

Campbell and Isherwood Ltd.

This concern reports a net profit of £30,553 (*£31,604*) for the year ended Dec. last. The dividend is again 15%.

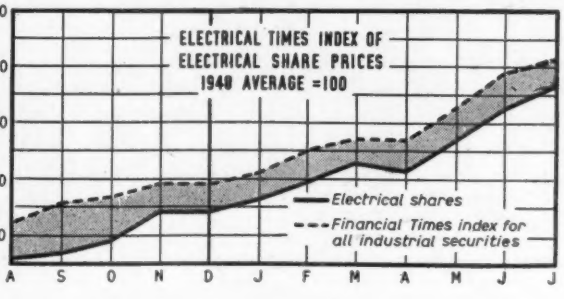
Electrical Switchgear and Associated Manufacturers Ltd.

After charging depreciation, the consolidated profit for the twelve months to 31 Mar. last amounts to £233,899 (*£324,146*). After taxation, etc., the net profit is £63,350 compared with £84,374 a year ago.

Hackbridge and Hewittic Electric Co.

It is hoped that the extension to the main transformer assembly bays and test equipment will be in use within a few months, Mr T. F. Lister, the chairman, states. The company will thus be in a position to quote much earlier delivery dates for the largest of transformers. After referring to the decline in orders and the difficulties in overseas markets, Mr Lister draws attention to the gradual reduction in the figure relating to stocks and work in progress, standing at £1,060,886—a decrease of £238,000 due primarily to a reduction of work in progress both in the Transformer and Rectifier Divisions.

Overall, share prices continued to rise during June although there was a decline mid-month. At the end of June the "Financial Times" index for all industrial shares showed an increase of 3 to 131·6 while the "Electrical Times" index for electrical shares rose from 122·2 to 126·3


ELECTRICAL TIMES INDEX OF ELECTRICAL SHARE PRICES 1948 AVERAGE =100
140
130
120
110
100
Electrical shares
Financial Times index for all industrial securities
A S O N D J F M A M J J

Hick, Hargreaves and Co. Ltd.

There is to be a final dividend of 15% on the capital which was increased by a 50% free scrip last January. With the 5% interim, this makes a total equivalent of 18½% on the larger capital. The net profit for the year ended 31 Mar. last is £208,107, against £168,065 for the previous year.

Johnson Matthey and Co. Ltd.

In addition to raising the distribution by 6% to a total of 21% for the year ended 31 Mar. last, it is proposed to make a 200% scrip issue. The group net profit for the year is £566,011 (*£638,825*).

Lightfoot Refrigeration Ltd.

A final ordinary dividend of 3% again makes a total of 6% for the year ended 31 Dec. last. The consolidated trading profit for the period is £56,785 (*£65,881*).

Joseph Lucas (Industries) Ltd.

It is proposed to increase the capital to £15 millions by the creation of 7 million new £1 shares of which 900,000 will be Redeemable Preference, and to capitalise £6,885,045 by a one-for-one Ordinary and Redeemable Preference scrip issue. It is also proposed to issue further 150,000 Redeemable Preference shares at par to Lucas Workers' Share Bank.

Mexican Light and Power Co.

Authority to increase the Common shares from 1,776,836 to 2½ millions, has been approved.

Oldham and Sons Ltd.

The dividend for the year to 31 Mar. last is maintained at 17½% with a final of 10%. The profit figure for the period is £270,750 (*£262,541*).

Oriental Telephone and Electric Co.

For the year ended 31 Dec. last, the total dividend is again 16%, with a final of 12%. The group net profit for the year is £211,549, against £113,610 for the previous year. Consequent to the acquisition of the company's telephone business by the Government of Singapore and Federation of Malaya on 31 Dec. 1954, the basis of assessment to income tax and of the charge in the profit and loss account in respect thereof is changed, it is explained. As a result £66,055 previously set aside and now rendered surplus has been credited in the profit and loss appropriation account. Profits of the group have been increased as a consequence in the results of branch trading of £68,247 and a reduction in the taxation charge of £26,821.

Permali Ltd.

In its continued expansion this concern has introduced new materials and extended its laboratory. Mr C. F. Hitchins, chairman, states that the new period has been started with a substantial order book. In North America, sales have expanded, and it is possible that the directors will decide upon the transfer of at least a partial manufacturing arrangement to the U.S. The Canadian concern at the end of its second year has reached the position where its turnover is practically sufficient to carry outgoing expenses.

Pye Ltd.

The group profit for the year to 31 Mar. last at £1,127,886 is £383,913 higher than that of a year ago. The Deferred dividend is 20%.

Revo Electric Co. Ltd.

The final dividend is 5¼% making a total of 9% for the year ended 31 Mar. last, on capital which was trebled by a scrip issue. The total for 1952 was 27½%. The consolidated net profit for the past year amounts to £48,904, compared with £171,590 for the previous year. According to the directors, this reduction is due to a number of adverse factors, the most important of which were the extra costs arising from the reorganisation of the works. Coincident with this a general recession in trade took place in the first part of the year while costs increased in all directions throughout the year without it being possible to make corresponding adjustments in selling prices.

Victoria Falls and Transvaal Power Co.

There is to be a fifth distribution of 7s. per £1 Ordinary unit next month, the liquidators announce. This will make a total of £8. 15s. per unit so far.

Walsall Conduits Ltd.

The group trading profit, before tax, for 1953 is £405,561 which is £45,344 more than for the previous year. After taxation, the net profit is £146,131 (*£159,192*). There is a total dividend of 35% plus bonus 15%, again making a total of 70% for the year. Mr A. E. Read, the chairman, states that competition was keen last year, but re-organised methods of production have enabled many selling prices to be reduced. Exports reached record figures. The company has a full order book, while sales for the first five months of 1954 are again up.

Year to Dec. 31	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1949	346,508	147,581	172	70	62/3	51/3
1950	448,838	219,021	270	70	59/–	52/3
1951	502,281	209,434	259	70†	64/1	55/–
1952	405,067	159,192	143	70	47/6	34/1
1953	448,140	146,131	128	70	47/6	44/3

†Plus 33⅓% capital bonus.

Ward and Goldstone Ltd.

In addition to increasing the annual dividend by 5%, there is to be a 100% scrip bonus issue. The final Ordinary dividend for the year to 31 Mar. last is 35% (*30%*), making a total of 50% (*45%*). The consolidated net profit for the period, after taxation, amounts to £266,616 against £197,536 previously.

Electric Supply News

East Midlands

Schemes estimated to cost a total of £1,383,912, have been approved by the East Midlands Electricity Board. Of this amount, £599,589 is the estimated cost of supplies to 10,330 new houses, £401,791 for reinforcement and voltage standardisation, £238,977 for industrial supplies, £120,585 for rural development and the remaining £22,970 comes under the heading of "other schemes."

Eastern Board

A further 4,991 consumers, including 125 farms were connected by the Eastern Electricity Board during the month of May last. The month also saw the erection of 70·4 miles of h.v. mains and 53 miles of l.v. mains by the Board.

Edinburgh

During tests of switchgear at Portobello power station, electricity supplies to a large part of the city were cut off for a short time on Sunday, 27 June. The experiments being carried out at Portobello at the time, were designed to deal with any emergency such as occurred at Dalmarnock earlier this year. Mr J. F. Field, Divisional Controller, S.E. Scotland Division, B.E.A., has stated that interruption to supply was caused during protective gear tests carried out on distribution feeders in preparation for further tests on fire-fighting apparatus installed for the protection of the station switchgear. It was known that there was an element of risk to the security of supply during the tests, and for that reason Sunday was chosen. Unfortunately the worst thing did happen and there was a general tripping of the 33 kV switches. In addition a fault developed in a cable near the power station, but this was subsidiary to the main cause of the trouble.

Harwich

For many years British Railways have provided a supply to their properties and other private consumers situated on or near to the railway extending from Parkeston to Manningtree. British Railways have given notice to terminate the supply and have asked the Eastern Electricity Board to take over those consumers. To effect this change the Board will have to erect four h.v. spur lines with substations and l.v. mains. The Board is also to take the opportunity to connect up several additional farms during the course of this work.

N. of Scotland

In the construction of the North of Scotland Hydro-Electric Board's Loch Shin power scheme, the first explosive charge was fired this week on the site of the new dam which is to be constructed.

Richmond (Yorks)

The Town Council has asked the North-Eastern Electricity Board to place proposed electric cables on the housing estate underground instead of overhead. The Council has also discussed the matter with the county planning officer.

Sherborne

The question of "frequent power failures" is to be taken up with the Southern Electricity Board's head office by the local Chamber of Commerce. At a recent meeting of the Chamber one member said he had kept a record of local power failures. Since Aug. 1952 there had been 28 of varying duration, he said.

Shotton (Co. Durham)

The North-Eastern Electricity Board is to take over the local electricity network from the National Coal Board next year. It is proposed to spend over £100,000 improving the network to bring it up to modern standards.

Staythorpe

Newark Rural District Council has decided to associate itself with the Southwell R.D.C.'s objections to the proposals for the second major stage of construction at Staythorpe power station, to which we referred last week. Newark Town Council have also agreed to support any recommendations which the rural council might make on the matter.

LIGHTING SCHEMES

Belfast. The R.D.C. is to spend £200,000 in the next five years on improving street lighting.

Blackburn. T.C. making application for consent to borrow £7,990 for relighting Wiltshire bus route from Penny St, to the borough boundary.

Camberwell. The M.o.T. has now authorised the Council to spend an extra £10,000 on the erection of another 559 sodium street lamps in side roads.

Ilford. The borough engineer has been authorised to prepare a list of priorities for improved street lighting for the next two years.

Newark. T.C. is recommended to approve a scheme for the conversion of gas lighting in Bowbridge Rd and Boundary Rd to electricity.

Prestwick. The T.C. is seeking Ministerial approval to a £23,000 scheme for converting all street lighting from gas.

Romford. The T.C. is to spend £9,720 on converting lighting in 33 streets from gas to electricity.

St. Helens. Sanction has been received to borrow £10,767 for street lighting within a quarter-mile radius of the town centre.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

9 July—N. Ireland. Installation in shop and 12 dwellings at Hilden.—See 1 July issue.

10 July — Bournemouth T.C. Sodium vapour main road lighting units. — See 24 June issue.

12 July—Aireborough U.D.C. Columns and brackets, and lanterns for lighting along 2¼ miles of A.658.—See 1 July issue.

12 July—Brentford and Chiswick T.C. Street lighting columns, lantern units, and control gear in Great West Rd.—See 24 June issue.

12 July—Camberwell B.C. Two pedestrian controlled electric trucks.—See 24 June issue.

12 July—Keighley T.C. Concrete columns, arms and equipment for street lighting on Braithwaite estate.—See 1 July issue.

12 July—Maidstone T.C. Rewiring and relighting at Corn Exchange.—See 24 June issue.

12 July—Queensbury and Shelf U.D.C. Sodium street lighting equipment for about 62 points.—See 17 June issue.

13 July—Newhaven U.D.C. Street lighting poles and fittings for 1¼ miles of main road.—See 1 July issue.

14 July—Co. Antrim. Installation at intermediate school, Larne. — See 24 June issue.

14 July — Cumberland. Installation of electricity at St. John's and St. Michael's schools at Workington.—See 1 July issue.

14 July—Dundee. Rewiring at Dept. of Civil and Mechanical Engineering and of Fleming Gymnasium in University College. Mitchell, Dey and Lackie, 34 Castle St, Edinburgh.

14 July—Newcastle-on-Tyne T.C. Installation in 215 houses on Fawdon estate. —See 24 June issue.

15 July—Lancashire. Electrical installation at Widnes police station. Apply by above date to County Architect, P.O. Box 26, County Hall, Preston. Deposit £2.

15 July—Newbury T.C. Installation in Newbury Hse.—See 1 July issue.

15 July—Roxburgh. Installation at West End, Denholm.—See 1 July issue.

15 July—Sutton and Cheam T.C. Sodium street lighting scheme along about 3·15 miles of roads.—See 24 June issue.

16 July—Sheffield T.C. Installation at Hinde House, and Silverdale schools. —See 1 July issue.

16 July—Slough T. C. Supply and erection of submersible electrically driven pumping unit for waterworks. Borough Engineer, Town Hall.

19 July—Belfast. Electrical installation in single-storey buildings at Purdysburn Hospital. N. Ireland Hospitals Authority's Chief Engineer, Victory Buildings, 44-46 Queen St. Deposit £3. 3s.

19 July—Dumfries. Electrical work in boilerhouse at Royal Infirmary.—See 1 July issue.

19 July—Durham T.C. Rewiring of town hall.—Advertised in 24 June issue.

19 July—Liverpool. Rewiring of annexe at Sefton General Hospital. Garnet Chaplin, secretary to S. Liverpool Hospital Management Committee, Sefton General Hospital.

19 July — King's Lynn T.C. Vertical spindle borehole type pump with ancillary equipment. — See 17 June issue.

19 July—Manchester T.C. Installation at Park Hall, Thurloe St.—Advertised in 1 July issue.

19 July—Midlothian. Supply, erection, etc., of 13 concrete columns, 140 W sodium lamps, lanterns and fittings along trunk road A7 at Newtongrange. County Surveyor, 32 Palmeston Place, Edinburgh.

19 July—Oldham T.C. Columns and lanterns for group A street lighting.—Advertised in 1 July issue.

19 July—Southend-on-Sea T.C. Installation in West Leigh school.—See 1 July issue.

19 July—West Riding. Lighting installation at Thorne grammar school. County Architect, Bishopgarth, Westfield Rd, Wakefield.

20 July—Epping U.D.C. Installation of electricity in 20 houses.—Advertised in 10 June issue.

21 July—Chadderton U.D.C. Supply of 70 140 W and 55 60 W totally enclosed sodium lanterns, and 125 transformers, capacitors and time switches (70 of which, 140 W sodium lamps, etc., for class A and Surveyor, Town Hall.—Advertised in this issue.

21 July—Crosby T.C. Erection only of 56 steel columns with brackets; and supply and erection of 56 lanterns, 140 W sodium lamps etc. for class A street lighting at Seaforth. Borough Engineer and Surveyor, Town Hall, Waterloo, Liverpool 22.

21 July—Wandsworth B.C.—Supply and erection of concrete columns, etc., for group A street lighting. Also, supply of 140 W sodium lamps and jackets. Separate contracts. Borough Engineer, Municipal Buildings, S.W.18.—Advertised in this issue.

22 July—Hawick T.C. Electrical installations in 23 blocks of houses (58 dwellings) in Burnfoot and Burnhead scheme. J. A. W. Grant, chart. arch., 36 Melville St, Edinburgh, or Burgh Surveyor, Hawick.

22 July—Maidenhead T.C. Erection only of 52 concrete lighting columns; fixing of 52 fluorescent lanterns and auxiliary gear; and wiring. Borough Engineer and Surveyor, 14 Cranfurd Rise. Deposit £2.

23 July—Sunderland T.C. Electrical installation in Hylton Red Hse infants' school. Borough Architect, Grange Hse, Stockton Rd. Deposit £1. 1s.

26 July—Leeds. Electrical services in twin operating theatre unit at County Hospital, York.—See June 17 issue.

27 July—Clackmannan. Supply and erection of 19 columns, sodium lanterns with control gear, etc., for relighting trunk road A19. N. A. Scorgie, county clerk, County Buildings, Alloa.

28 July—Ilford T.C. Plant and equipment, for Roden St sewage pumping station.—Advertised in 24 June issue.

29 July—Belfast T.C. Supply and erection at Power Station West's first extension of one 4-ton mobile crane. Tender N.1511. Merz and McLellan, consulting engineers, Carliol Hse, Newcastle-on-Tyne. Deposit £5. 5s.—Advertised in this issue.

30 July—Taunton T.C. Sewage and storm water pumping plant, etc.—See 10 June issue.

31 July—Belfast. Installation in St. Patrick's Training School.—See 1 July issue.

5 Aug.—Belfast T.C. Electrical installation in bakery school at 182 Ormeau Rd, Education Architect, 40 Academy St.

7 Aug—Pwllheli T.C. Lighting installation for auditorium of Town Hall. Borough Surveyor, Municipal Offices.—Advertised in this issue.

9 Aug—Kidderminster T.C. Supply and erection of lighting and power installations, including fluorescent and tungsten fittings, in the Retail Market, High St. Apply by 16 July to Winton Thorpe.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 103 queries answered this week

Dummy food for use in refrigeration displays, makers of? F.W.M.—R. R. Thompson Ltd., 38 Chestnut Grove, New Malden, Surrey.

"Downe" (London) instrument steriliser, makers of? N.W.E.—We presume this refers to one of the products of Down Bros. and Mayer and Phelps Ltd., 92 Borough High St, S.E.1.

13 amp, fused, rubber plugs, makers of? S.E.E.B.—Wm. Sanders and Co. (Wednesbury) Ltd., Riddings Lane, Wednesbury, Staffs; Walsall Conduits Ltd., Excelsior Works, West Bromwich, Staffs.

"Martins" steam raising boilers, makers of? Y.E.B.—Martin's Cultivator Co., Ltd., Lincolnshire Iron Works, Ryhall Rd, Stamford, Lincs.

Burglar alarm matting, makers of? B.C.L.—Rely-a-Bell Burglar and Fire Alarm Co., Ltd., 54 Wilson St, E.C.2.

"Spinney" irons, suppliers of? E.M.E.—Littlewoods Mail Order Stores Ltd., Kershaw Ave., Crosby, Liverpool 23.

"Rayton" immersion heaters, makers of? T.E.—Santon Ltd., Somerton Works, Newport, Mon.

Tunnadine and Partners, consulting engineers, 100 Victoria St, London, S.W.1. Deposit £2. 2s.—Advertised in this issue.

13 Aug.—Co. Tyrone. Electrical installation at Dungannon secondary intermediate schools. J. M'Candless, consulting engineer, 6 Murray St, Belfast. Deposit £3. 3s.

19 Aug.—Belfast T.C. Boiler feed pumps for first extension of Power Station West.—Advertised in 1 July issue.

27 Aug.—Leeds T.C. Supply, erection, etc., of two electrically-driven multi-stage centrifugal pumps with electric motor and switchgear. General Manager and Engineer, Waterworks Dept., Civic Hall.

No date stated—Aberdeen. Installation at Drumoak library.—See 1 July issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

14 July—India. Supply, laying, etc., of 12,600 yd armoured submarine telephone cable and accessories for Bombay Port Trust, Marine Oil Terminal. Documents from Sir Bruce White, Wolfe Barry and Partners, 1 Lygon Place, Grosvenor Gdns., London, S.W.1, at 10s. per copy.

20 July—Canada. T. Eaton Co., Ltd, Winnipeg, invite tenders for supply of 500 kVA/450 kW turbo-generator unit for power house. B.o.T. (Ref.: ESB 16460/54).*

29 July—India. Tenders (No. Engg./SPI/15015/E/II/54) invited for supply of vacuum impregnating plant comprising impregnator, vacuum exhauster, varnish container with electrical heating, and piping, etc. Directorate General of Supplies and Disposals, Govt. of India, Shahjahan Rd, New Delhi. B.o.T. (Ref.: ESB 15553/54).*

30 July—India. Supply of 20 power transformers of capacities 100 kVA to 1500 kVA for Electricity Dept. of Govt. of Bihar, Patua. Documents (for Rs. 5) from Superintending Engineer. B.o.T. (Ref.: ESB 16564/54).*

3 Aug.—Australia. Electricity Trust of S. Australia invites tenders (No. 649) for supply of 27 33,000/11,000 V Delta/Star 3-phase transformers, between 150 kVA and 10,000 V. B.o.T. (Ref.: ESB 15844).

3 Aug.—Australia. Supply of main power switchboard of unit type built of fabricated sheet steel. Supply is a.c. 50 c/s 3-phase four wire M.E.N. 400/230 V. Tender No. 531. Dept. of Works, Melbourne. B.o.T. (Ref.: ESB 16006/54).*

17 Aug.—Uruguay. Supply (under tender No. 2284) of 8,000 insulators for main voltage of 6 kV and 15 kV (4,000 each) between phases. Guarantee of U.R. $1,200 required. Administracian General de las Usinas Electricas y los Telefonos del Estado. B.o.T. (Ref.: ESB 16019/54).

19 Aug.—South Africa. Supply, etc., of seven electrically driven pumps with motors, etc., for Union Tender and Supplies Board, Bosman and Schoeman Sts., P.O. Box 371, Pretoria. Tender No. 68-1954/55. B.o.T. (Ref.: ESB 15278/54).*

3 Sept.—Australia. Supply of six 7,500 kVA 3-phase, 50 P.P.S. 33,000 V delta to 11,000/6,350 V star, step down outdoor type transformers with oil and onload tap changing. Tender No. E19/54. Specification from Chief Engineer and Manager, Dept. of Electricity, Kelvin Hse, Adelaide St, Brisbane, at 10s. 6d. per copy.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 6 July

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	240½	+1½	252
„ (3 months)	237½	+½	—
LEAD, refined pig, min. 99·97% purity (cash)	96½	−1½	89½
„ (3 months)	94½	−½	87½
TIN, refined, min. 99·75% purity (settlement)	758	+8	607½
„ (3 months)	747	+1	608½
ALUMINIUM, ingots 99-99·5%	156	—	150
ZINC, virgin, min. 98% purity (cash)	78½	+½	71½
„ (3 months)	79½	—	71 7/16
RUBBER No 1, RSS. spot (per lb.)	21½d.	+1½d.	19½d.
„ c.i.f. basis, ports. Sept. (per lb.)	21 5/16d.	+1 5/16d.	19½d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52	—	50½
Mild Steel Tape (0·014 in.)	40½	—	40

Contracts Placed

B.E.A. Two 30,000 kW turbo-generators, condensing and feed heating plant at Acton Lane B, Richardsons, Westgarth (Liverpool), Ltd.; Two 60,000 kW turbo-generators at Belvedere, English Electric Co., Ltd., Three 550,000 lb/hr boilers at same, John Brown and Co. (Clydebank), Ltd., and condensing and feed heating plants for two 60,000 kW turbo-generators at same, Mirrlees Watson Co., Ltd.; One 30,000 kW turbo-generator and feed heating plant at Hackney, C. A. Parsons and Co., Ltd., and condensing plant for one 30,000 kW turbo-generator at same, Worthington-Simpson, Ltd.; One 550,000 lb/hr boiler at Barking, Babcock and Wilcox, Ltd.; One 60,000 kW turbo-generator condensing and feed heating plant at Brighton B, Richardsons, Westgarth (Liverpool) Ltd.; One 30,000 kW turbo-generator and feed heating plant at E. Yelland, C. A. Parsons and Co., Ltd.; Condensing plant for one 30,000 kW turbo-generator at same, G. and J. Weir, Ltd., and one 180,000 lb/hr at same, John Thompson Water Tube Boilers, Ltd.; One 30,000 kW turbo-generator at Goldington, British Thomson-Houston Co., Ltd., and condensing and feed heating plant for one 30,000 kW turbo-generator at same, G. and J. Weir, Ltd.; Ash and dust handling at S. Denes, B.V.C. Industrial Constructions, Ltd.; One 540,000 lb/hr boiler at Tilbury, John Thompson Water Tube Boilers, Ltd.; Two 100,000 kW turbo-generators, condensing and feed heating plants at Castle Donnington, Metropolitan-Vickers Electrical Co. Ltd.; One 100,000 kW turbo-generator, condensing and feed heating plant at Willington, English Electric Co., Ltd., and ash and dust handling plant at same, Babcock and Wilcox, Ltd.; Three 550,000 lb/hr boilers at Hams Hall C, Simon-Carves Ltd., and coal handling plant at same, Mitchell Engineering, Ltd.; Two 30,000 kW turbo-generators with feed water heating, condensing plant and auxiliary apparatus at Ocker Hill, Richardsons, Westgarth and Co., Ltd.; One 60,000 kW turbo-generator at Uskmouth B, English Electric Co., Ltd., and condensing and feed heating plant for one 60,000 kW turbo-generator at same, Vickers-Armstrongs, Ltd.; One 10,000 kW hydro-turbo-generator, at Dolgarrog, Boving and Co., Ltd.; One 100,000 kW turbo-generator, condensing and feed heating plant at Ferrybridge B, C. A. Parsons and Co., Ltd.; One 60,000 kW turbo-generator and feed heating plant at Wakefield, English Electric Co., Ltd.

Gazette Announcements

COMPANIES ACTS

Vac Cine Accessories Ltd. Resolution for voluntary winding-up passed at meeting on 21 June. W. Whitson, C.A., of 9 Cavendish Sq, London, W.1, was appointed liquidator.

Micox Electrical Equipment Ltd. At meeting on 15 June, resolution passed for voluntary winding-up, and D. A. Lumley of 2 Burwood Rd, Hersham, was appointed liquidator.

Peco Electrical Contractors Ltd. Meeting will be held at offices at Poppleton and Appleby, 31 Lloyd St, Manchester, on 13 Aug. at 12.30 p.m. to receive liquidator's report.

Lancaster Electric Co. (Enfield) Ltd. Last day for receiving proofs in respect of intended dividends is 14 July. Liquidator is F. M. Collins, Official Receiver, Inveresk Hse, Strand, W.C.2.

Voluntary Liquidation

F. W. Shearman Ltd., radio and electrical engineers. At statutory meeting of creditors statement of affairs presented showing liabilities £9,070. Assets estimated to realise £2,685 and after allowing £294 for preferential claims, there were net assets of £2,391, or deficiency as regards creditors of £6,679. Issued share capital was shown at £1,000 and, so far as members were concerned, there was a total deficiency of £7,679. After discussion creditors present passed resolution confirming voluntary liquidation with Mr Metcalf Collier, of 199 Piccadilly, London, W.1, as liquidator. Committee of inspection also appointed.

Winding-Up

W.E.K. (Electrical) Ltd., electrical instrument manufacturers. Liabilities of £2,128, due to Inland Revenue, were mentioned at first meeting of creditors held on 22 June. No statement of affairs filed and although full amount of assets was not known, there was said to be £270 cash at bank. Official Receiver reported that company was formed in 1935, with nominal capital of £2,000, later increased to £10,000, of which £1,407 had been issued. Resolution passed for appointment of Mr T. J. M. MacLeod, C.A., 4 Bucklersbury, E.C.4, as liquidator.

BANKRUPTCY ACTS

Dividends

Worcester. Harry Bullock trading as H. Bullock and Sons at 17 High St, Bromyard. First and final dividends of 2s. 11d. in £ payable at Trustee's Office, Colmore Hse, 21 Waterloo St, Birmingham, on 17 July.

BUSINESS PROSPECTS

Home

Aberdeen. East wing of Glenburn Hospital to be modernised.

Airdrie T.C. Flashing beacons to be installed at cost of about £1,021.

Bath T.C. It is proposed to build 350 houses between Whiteway and Twerton.

Bedfordshire. Approval given to erection of secondary modern school at Elstow, costing about £106,100; and in principle to sketch plans for Eastcotts-Shortstown primary school.

Bedford. First part of phase one of North Bedfordshire College of Further Education will cost about £134,753.

Billingham-on-Tees U.D.C. Plans approved for secondary modern school near Marsh Hse Ave.

Bishop Auckland U.D.C. Approval granted for erection of between 200 and 300 houses at Witton Pk.

Bolton. Springfield Paper Mills, off Bradford St, are to be extended for J. W. Marshall and Co., Ltd.

Bournemouth. Erection of Winton and Moordown secondary school has been approved. Estimated cost, £187,000.

Bridgwater T.C. Plans approved for 411 houses on Sydenham estate.

Bridlington T.C. Erection of 30 houses on West Hill estate. Borough Engineer, Town Hall, or C. E. Culpin, architect, 3 Southampton Place, London, W.C.1.

Bristol. Tenders may soon be invited for erection of head office for Bristol Trustee Savings Bank.

Chester-le-Street R.D.C. Twenty-eight houses to be built in Cross St, Sacriston. Land to be developed at Nettlesworth also.

Co. Down. Construction of 71 houses at Ballynahinch. N. Ireland Housing Trust, 12 Hope St, Belfast.

Crediton U.D.C. Erection of 40 houses at Butt Parks. F. W. Beech and E. Curnow Cooke, council's architects, 15 Dix's Field, Exeter.

Dewsbury. Plans submitted for new R.C. church and hall in Chickenley Lane.

Doncaster. Roger Preston and Partners, 15 North Audley St, London, W.1, have been appointed consulting engineers for development of Infectious Diseases Hospital.

Dorchester T.C. Revised plans to be prepared for 12 bungalows and 90 houses on remainder of Poundbury site.

Dublin T.C. Construction of 204 houses in Finglas West area. City Treasurer, Exchange Buildings, King Edward St.

Dumfries. District Arts and Community Assoc. are planning to build £18,000 theatre. Plans by Miss I. H. K. Beattie, architect, The Thrush Wood, Monswald.

Eastbourne T.C. Erection of block of 16 flats and two shops in Langney Ave. and block of 12 flats in Victoria Drive. Borough Surveyor, 2 Saffrons Rd.

Edlington. N.C.B. to build 110 houses on site of demolished bungalows.

Eton (Bucks). Sir William Holford, 5 Cambridge Terr, London, N.W.1, is architect for erection of new boys' house (Farrer House) at Eton College. Cost estimated at £200,000.

Falkirk. Dean of Guild Court has approved erection of fire station and houses in Grangemouth Rd. costing £35,800.

Gillingham (Kent) T.C. Erection of 151 dwellings on Twydall/Beechings estate. Borough Engineer's Dept., Municipal Buildings.

Grangemouth T.C. Plans approved for 1,300 houses in first development of Airfield site.

Greenock. Scheme approved for public baths and swimming pool and new sports stadium at Ravenscraig. Total estimated cost £35,000.

Halesowen. Planning approval granted for erection of factory at Cradley for Wombourn Manufacturing Co., Ltd., of Wolverhampton.

Hebburn-on-Tyne U.D.C. It is proposed to erect another 72 houses and flats on Monckton Lane No. 1 site.

Ipswich. County Hall is to be rewired, and existing fittings to be replaced by fluorescent and other modern lighting. Cost will be about £900.

Ketton (Rutland) R.D.C. Further 42 houses to be built to complete estate at Ryall. Council's Architect is W. J. Hemming, Broad St, Stamford.

Lanark. Eighty-eight houses to be built at Meadowside costing about £132,957.

Leeds. Erection of additions to Brandesburton Hall Hospital, Driffield, for Hospital Board. Wheatley and Houldsworth, chart. archs., Savile Hse, Savile St, Hull.

Llangefni (Anglesey). Factory to be built on old prisoner of war camp site now known as Peneraig, for Welsh Agriculture and Industries Ltd. T. Alwyn Lloyd and Gordon, 6 Cathedral Rd, Cardiff, are architects.

London. Nightingale Bros. are planning factory on N. Circular Rd. Plans by W. W. Willcocks, 34 Park Hall Rd, N.2.

Long Ashton (Som) R.D.C. Approval granted for erection of 2 blocks of 2-storey flats, 12 bungalows and 83 houses on Southfield Rd. site, Nailsea.

Macclesfield T.C. Erection of 40 houses at Hurdsfield. Borough Architect, 3 Jordangate.

Manchester T.C. Construction of 62 dwellings in five blocks in Mitchell St. Director of Housing, Town Hall.

Mangotsfield U.D.C. Erection of 50 houses at Staple Hill. Surveyor, Council Offices, Staple Hill, Bristol.

Meath (Eire). Plans approved for 32 houses at Lavtown.

Meath. Technical schools to be built at Navan (£55,000), Athbey (£20,000), and Oldcastle (£16,000).

Middlesbrough T.C. Development plan approved providing for 1,000 houses, two public houses, shops, library, school, etc., in Easterside Rd, area. Work to begin next year.

Midhurst (Sus) R.D.C. Construction of 12 dwellings at Cocking, 8 at Elsted and 6 at Trotton. Architect, "Newstead," Midhurst.

Musselburgh T.C. Erection of 3-storey block of 23 flats in New and Bush Sts area. Burgh Surveyor, Municipal Offices.

Newcastle-on-Tyne T.C. First stage of plan for new municipal offices has been approved. Total cost calculated to be £1,600,000 and first section estimated at £461,000.

Nottinghamshire. Approval given for erection of factory in Stoke Lane, Stoke Bardolph, for Bitterlings Ltd., of Meadow Lane, Nottingham.

Ongar R.D.C. Erection of 26 houses on Shelley estate. Engineer and Surveyor, Bowes Field, Ongar, Essex.

Peterborough. Structural alterations costing about £37,500 to be carried out at St John's Hospital for E. Anglian Hospital Board.

Plymouth. The Neuchatel Asphalte Co., Ltd., are to build new depot and offices at Richmond Walk. A. French and Partners, of 23 Westwell St, are architects.

Portsmouth T.C. Plans in hand to build total of 324 houses at Leigh Park, Havant.

Sheffield T.C. Construction of ten blocks of 4-storey maisonnettes (120 dwellings) on Greenhill-Bradway estate. J. L. Womersley, City Architect, Town Hall.

Sittingbourne and Milton U.D.C. Erection of block of 5 shops with 10 maisonettes on Canterbury Rd estate. Engineer and Surveyor, Council Offices, High St, Sittingbourne.

Somerset. John C. Small and Tidmas Ltd. are to build new factory at Chard. Cost is estimated at £50,000.

South Shields. Second instalment of scheme for new marine and technical college will be included in next year's building programme. Architects are Meade, Taylor and Wilson, 17 Sheffield Terr, Camden Hill, London.

Spalding. Alterations and extensions proposed at Johnson Hospital for Sheffield Hospital Board.

Twickenham. Three-storey building to be erected in Heath Rd, for Ministries of National Insurance and Labour.

Wakefield T.C. Further 136 houses to be built. Also, Close Asbestos and Rubber Co., Ltd., are planning factory in George St, Architect is W. H. Ogden, 33 Peterson Rd.

Warwick T.C. Erection of 30 houses in St Michael's Rd. R. Wormwell, Borough Engineer and Surveyor, 23 Jury St.

Weymouth. Ritz Theatre and Palm Court Dance Hall is to be rebuilt at cost estimated at £57,969.

Wigan. Application of Heinz Ltd. to build factory at Kitt Green has been approved.

Overseas

Mexico. Representation of U.K. manufacturers wanted in following lines: very large a.c. generators; porcelain isolators; hydraulic turbines of large capacity; cable and wire for power stations and transmission; galvanised transmission towers; water valves for H.E. stations with automatic control. Enquirer is Mr Alfred Rudich, president, General Supply Co., S.A. of Vallarta No. 1, Mexico 4, D.F.

U.S.A. Rural Electrification Admin. is exploring possibility of obtaining small telephone dial exchange switchboards from U.K. They should be suitable for small communities requiring from 5 to 14 circuits, but also 20, 25 and up to 40 circuits. R.E.A. do not purchase such equipment but individual organisations cannot buy without the R.E.A.'s approval. Those interested should send full details to British Vice-Consulate, 508 Peyton Building, 721 Riverside Ave, Spokane 8, Washington.

Roy J. Carver, president, Carver Pump Co., Muscatine, Iowa, is interested in importing from U.K. small integral and fractional h.p. single-phase motors. Requirements likely to be substantial.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Burkill's For Wireless Ltd., 93 Carlton St, Castleford. To take over business of radio and electrical engineers carried on at Castleford as Burkill's For Wireless. Nom. cap.: £1,000. Dirs.: Mabel Burkill (permt.), Phyllis C. Morgan, and Mildred Bailey-Smith.

Abbey T.V. Ltd., 47 Abbey St, Accrington. Salesmen, factors, agents and dealers in commodities of all kinds, electronic engineers, joiners, carpenters, etc. Nom. cap.: £3,000. Dirs.: to be appointed by subscribers. Subs.: H. Hoyle, Bran Llan, Gannock Park Deganwy, and T. Wilson, Woodside, Whalley Rd, Clayton-le-Moors.

Brillite Neon Signs Ltd. Nom. cap.: £500. Dirs.: not named. Subs.: J. Moore, 7 East Park Parade, Northampton, B. C. Freeman, Lucas Farm, Broughton Green Road, Northampton.

Chase and Son (Denton) Ltd., 4 Chapel Walks, Manchester 2. Motor, mechanical, electrical and general engineers, etc. Nom. cap.: £100. Dir.: J. H. F. Chase.

North East Radar and Electronics Co., Ltd., 53/5 Westmorland Rd, Newcastle-upon-Tyne 1. Nom. cap.: £1,000. Dirs.: A. W. Wanless and J. G. Barclay.

Plumstead Electrical Co., Ltd., 163 Burrage Rd, Woolwich, S.E.18. Nom. cap.: £100. Dirs.: J. A. Proctor, Gertrude M. Proctor, P. W. Tricker, D. Perfect and F. J. Pye.

J. Darwin (Neon Signs) Ltd., 32 Vale Rd, Bushey, Herts. Nom. cap.: £100. Dirs.: J. Darwin and Mrs. C. J. Darwin.

Industrionics Ltd. 171, Shaftesbury Av, W.1. Manufacturers of and dealers in industrial and domestic electronic equipment, etc. Nom. cap.: £100. Dirs.: A. Bloom and S. de Grasse.

J. G. Barnes and Co. (Hale) Ltd. 15, Grafton St, Altrincham. Electricians, radio and television and electrical engineers, etc. Nom cap.: £100. Permt. dir., Mrs. W. M. Purvis.

Auto-Electrical Services (St. Annes) Ltd. Back Glen Eldon Rd, St. Annes-on-Sea. Nom. cap.: £1,000. Dirs.: J. H. Chadwick, and A. French.

Szego Technical Services Ltd. 30, St. George St, W.1. To act as technical advisers in all types of metallurgical, chemical, electrical, mechanical and constructional and engineering affairs, etc. Nom. cap.: £100. Dirs.: M. Van der Borgh, F. W. Shilstone, W. A. Wales, R. S. Oliver, and L. Szego.

W. H. Hancock (Llandudno) Ltd. 18 Madoc St, Llandudno. To take over business of radio and electrical engineer and retailer carried on at Llandudno by Wm. H. Hancock. Nom. cap.: £500. Dirs.: W. H. Hancock and J. Martin.

Cape Electrophonics Ltd. 43/5 High St, Shirley, Southampton. Manufacturers of and dealers in electrical, electronic, electrophonic, musical and mechanical apparatus and instruments, etc. Nom. cap.: £1,000. Dirs.: H. L. York, T. L. Horton and N. L. Hearne.

Light Weight Battery Co., Ltd. Copthall Hse, 13 Copthall Av, E.C.2. To take over patents, etc., relating to experiments carried out in the construction and improvement of electrical storage batteries, etc. Nom. cap.: £100. Dirs.: C. H. Gadsden and F. L. R. Brown.

Western Electric Co., Ltd. Nom. cap.: £100. Dirs.: W. L. Brown, W. S. Tower, junr, and J. H. Somake. Subs.: J. H. Somake and I. A. Scott.

Kenton Recorders Ltd. Bank Chambers, 512/4 Brixton Rd, S.W.9. Manufacturers and exporters of and service agents and engineers in recording and reproducing devices and machines, etc. Nom. cap.: £2,000. Dirs.: J. K. Cooper and P. H. Wetherill.

Fergus Makin Ltd., 9 Eastnor St, Manchester 15. Electrical, wireless, telephone, lighting, heating and general engineers, etc. Nom. cap.: £5,000. Permanent dirs.: R. D. Makin and Mrs. G. Makin.

Direct T.V. Windings Ltd., 134/6 Lewisham Way, New Cross, S.E.14. Manufacturers and dealers in radio, radar, television, electronic and electrical components, windings and coils, etc. Nom. cap.: £1,000. Dirs.: A. Rose and Ethel Rose, and L. Hartless.

Dixon-Lesley Ltd., 28 St. Marys Place, Newcastle-on-Tyne, 1. Manufacturers of and dealers in electronic equipment and instruments, etc. Nom. cap.: £1,500. Dirs.: J. G. Dixon and Mrs I. Dixon.

J. E. Utting Ltd., Ninian Park Garage, Leckwith Rd, Cardiff. To take over business of motor engineer and electrical repairer carried on at Cardiff by John E. Utting. Nom. cap.: £2,000. Dirs.: J. E. Utting and W. A. Utting.

M.R.S. (Hackney) Ltd. 106, Forest Rd, Hackney, E.8. Retailers, wholesalers, manufacturers, importers and exporters of wireless receiving and transmitting sets, television receiving sets, etc. Nom. cap.: £1,000. Dirs.: A. R. Miller, Mrs. P. Miller, J. A. Miller and R. A. Miller.

Bissell and Birch Ltd. 141 Staines Rd, Hounslow, Middlesex. Lampshade, electrical goods manufacturers. Nom. cap.: £2,000. Dirs.: D. L. Birch and E. C. Ankers.

TRADE NOTES

Merger. The laboratory furnishing concerns of Griffin and Tatlock Ltd. and W. & J. George and Becker Ltd. are merging their organisations, but pending the administrative and physical integration, they will continue to trade, until further notice, under their existing names and at their present addresses. The name of the new company is Griffin and George Ltd. The chairman of the new concern is Mr R. McKinnon Wood, O.B.E., M.A., F.R.A.E.S., and the vice-chairman, Mr H. R. Bettinson, M.C.

New address. V. Leonard and Co., electrical, radio and television wholesalers, have opened new premises at 40/48 Berry St, Belfast.

The new sales office, showroom and stores of Mantel Metalworkers Ltd. are at 121 Gurney St, Walworth, London, S.E.17. Telephone Rodney 6441.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Caltex in design. 725,350. Class 17. Insulating oils. Regent Oil Co. Ltd., 117 Park St, W.1.

Morphy-Richards. 722,711. Class 21. Iron stands. Morphy-Richards Ltd., St. Mary Cray, Kent.

Unicorn. 727,323. Class 9. Electric flat irons. British Unicorn Products Ltd., 36/38 Southampton St. Strand W.C.2.

Thermotube. B724,364. Class 11. Tubular heating apparatus. E. K. Cole Ltd., Ekco Works, Priory Cresc, Southend-on-Sea.

Medlec. 726,039. Class 11. Lighting fitting. Moore and Partners (Eng.) Ltd., 3 Devonshire Grove S.E.15.

Pyrene. 727,588. Class 9. Fire indicating instruments, alarms, temperature rise detecting and indicating instruments, etc. Pyrene Co. Ltd., Gt West Rd, Brentford, Middlesex.

N.B.D. in design 719,587. Class 7. Alternators, motors and generators. 726,304. Class 9. Automatic voltage regulators, transformers and convertors, etc. Newton Bros. (Derby) Ltd. Alfreton Rd, Derby.

Clang. 727852. Class 9. Electrical conduit material. 727,852. Class 17. Flexible pipes and flexible tubing, all made principally of plastics. Clang Ltd, Crown Yard, Cricklewood, N.W.2.

Voltector. 729,957. Class 9. Voltage and electric field detecting and indicating apparatus. Hivolt Ltd., 34a, Pottery Lne, Portland Rd, W.11.

TELEPHONE MANUFACTURING Co.

Continued High Level of Sales

THE 24th annual general meeting of the Telephone Manufacturing Company Ltd., was held on 5 July in London, Mr Fred T. Jackson, O.B.E., COMP.I.E.E. (chairman and managing director), presiding.

The following is an extract from his circulated statement:

Our Sales have continued at a high level, and 20 per cent of the turnover was exported. We are finding that competition is very keen for export business, particularly from Germany. The work we have in hand will keep us busy for the remainder of the current year, but prices are much keener and we are finding new business more difficult to secure.

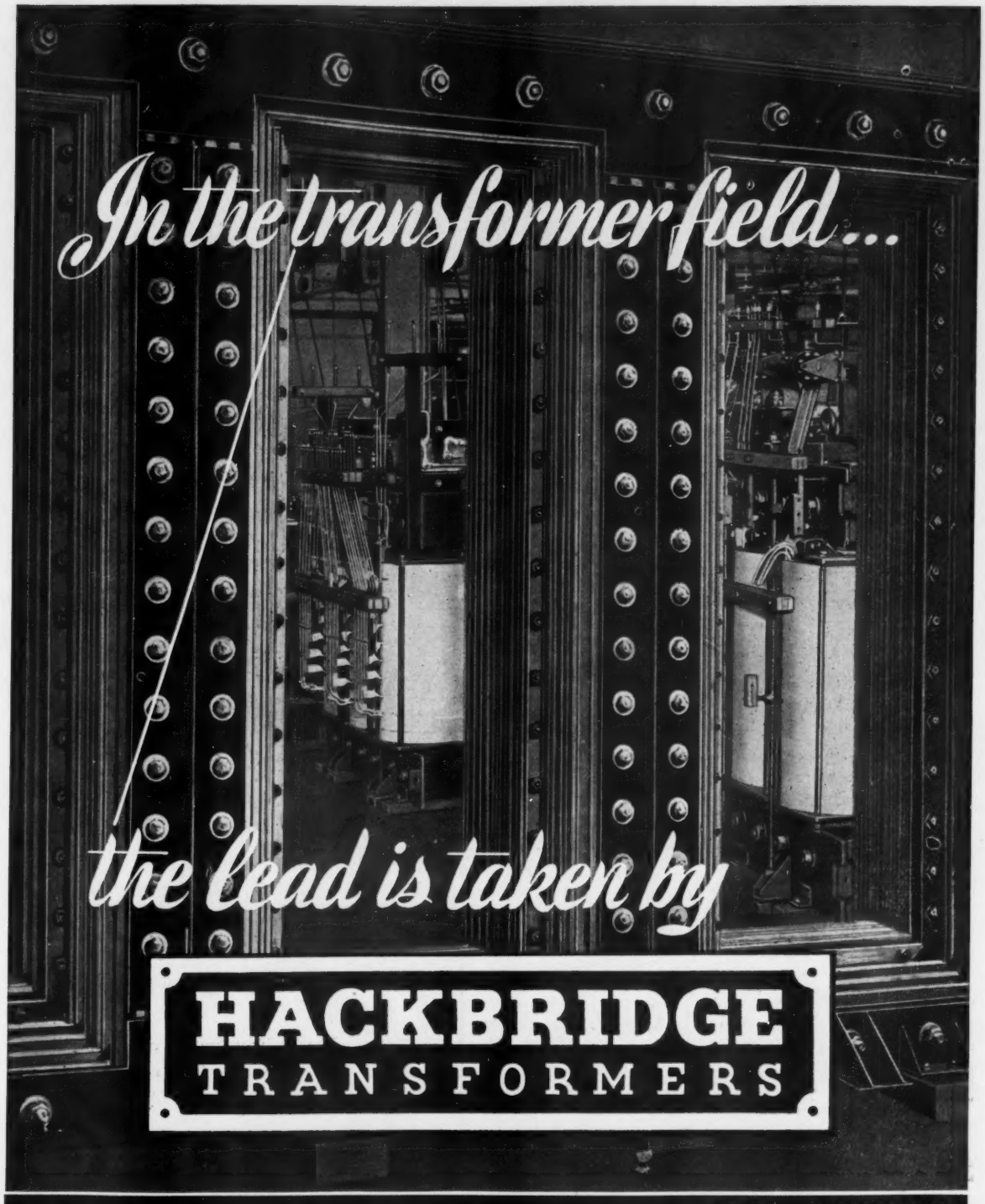
I think we can attribute a great deal of our success to constant work on development, for, in proportion to its turnover, your Company spends much on development.

I referred in 1951 to the establishment, in partnership, of a factory in Sydney, Australia. Progress is being made there and we think that eventually it will be very successful.

The Canadian Branch in Toronto continues to be active. I am of the opinion that in time this too will be a successful venture.

Looking ahead, heavy taxation is bound to have a very severe effect on the country's economy for if part of the amount paid away in taxes were utilised in industry it would produce revenue, provide employment and everyone would be better off.

The report was adopted and a total dividend of 10 per cent approved.



HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone: Walton-on-Thames 760 (8 lines) Telegrams: "Electric, Walton-on-Thames"

WESTON panel instruments

Both round and rectangular models of moving iron, moving coil, A.C. rectifier and H.F. thermocouple types are offered. In the range of rectangular instruments, which have been introduced to give the advantage of long, easily-read scales and to harmonize with rectangular panels, certain models are available with illuminated dials. Full particulars of types and ranges available are to be found in leaflets List Nos. W.1 and W.2, copies of which are available on request.

Rectangular panel instruments are available with scale lengths of 2·5″, 3·2″, and 4·2″. *These offer the advantage of an increase in scale length of approximately* 50% *over their equivalent round models, for which they can be used as direct replacements using the same panel fixing holes.*

Round models are housed in cases of 2″, 2½″ *and* 3½″ *diameter and have scale lengths of* 1·7″, 2·1″ *and* 2·8″ *respectively.*

Larger instruments, both round and rectangular and for switchboard or panel mounting, are also available. These have scale lengths of 6″ and 6½″ respectively.

SANGAMO WESTON LIMITED

Enfield, Middlesex · Tel: ENField 3434 (6 lines) & 1242 (6 lines) Grams: Sanwest, Enfield

Scottish Factory: Port Glasgow, Renfrewshire. Port Glasgow 41151
Branches: London, CHAncery 4971 · Glasgow, Central 6208 · Manchester, Central 7904 · Newcastle-on-Tyne, Newcastle 26867
Leeds, Leeds 30867 · Liverpool, Central 0230 · Wolverhampton, Wolverhampton 21912 · Nottingham, Nottingham 42403
Bristol, Bristol 21781 · Southampton, Soton 23328 · Brighton, Brighton 26497

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

METROPOLITAN BOROUGH OF WANDSWORTH

SODIUM LAMPS AND JACKETS

TENDERS are invited for the supply of 140 W Sodium Lamps and Jackets.

Tender forms, etc., obtainable from the Borough Engineer at the undermentioned address, must be returned to me by noon, Wednesday, 21 July, 1954.

R. H. JERMAN,
Town Clerk.

Municipal Buildings,
Wandsworth, S.W.18.
29 June, 1954. (K 376)

CITY AND COUNTY BOROUGH OF BELFAST
Electricity Department

ELECTRICITY (ESSENTIAL SUPPLIES) ACT (NORTHERN IRELAND) 1954

TENDERS are invited for the Supply, Delivery and Erection at the First Extension of Belfast Municipal Electric Power Station West of:

ONE 4-TON MOBILE CRANE

Form of Tender (N.1511), Conditions, Specification and Drawings, in quintuplicate, may be obtained from Messrs Merz and McLellan, Consulting Engineers, Carliol Hse, Newcastle-upon-Tyne 1, on payment of a deposit of Five Guineas, which will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the contract document may be obtained at One Guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in quadruplicate, in sealed envelope marked "Tender for Mobile Crane, Electricity Department" and endorsed with the name and address of the tenderer, must be addressed to the Town Clerk, City Hall, Belfast, so as to reach him not later than 4 p.m. on Thursday, 29 July, 1954.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

EYRE GORDON,
Chairman,
Northern Ireland Joint Electricity Committee.

Chichester Hse,
Chichester St, Belfast.
2 July, 1954. (K 389)

METROPOLITAN BOROUGH OF WANDSWORTH

STREET LIGHTING

TENDERS are invited for the supply and erection of concrete lamp columns and all ancillary gear for Group A Standard Street Lighting.

Tender documents, obtainable from the Borough Engineer must be returned to me by noon, 21 July, 1954.

R. H. JERMAN,
Town Clerk.

Municipal Buildings,
Wandsworth, S.W.18. (K 375)

CHADDERTON URBAN DISTRICT COUNCIL

STREET LIGHTING

TENDERS are invited for the supply of the following Street Lighting Equipment.

70 totally-enclosed 140 W Sodium Lanterns.

55 totally-enclosed 60 W Sodium Lanterns.

70 Transformers, Capacitors and Time Switches (140 W).

55 Transformers, Capacitors and Time Switches (60 W).

Specifications may be obtained upon application to the Engineer and Surveyor, Town Hall, Chadderton.

Tenders, enclosed in a plain, sealed envelope, endorsed "Street Lighting," are to be delivered to the undersigned by 21 July, 1954.

L. STOTT,
Clerk of the Council.

Town Hall,
Chadderton.
June, 1954. (K 374)

BOROUGH OF PWLLHELI

PROPOSED NEW LIGHTING SCHEME
TOWN HALL

TENDERS are invited by the Pwllheli Corporation from experienced Electrical Engineers for a scheme of lighting for the Auditorium of the Town Hall, Pwllheli. Starting date 4 Oct., 1954, and all work to be completed by 25 Oct., 1954.

Plans and further particulars to be obtained from the Borough Surveyor, Pwllheli, and all Tenders to be delivered in sealed envelopes marked "Lighting Scheme" to the undersigned, not later than 7 Aug., 1954.

CYRIL C. DAVIES,
Town Clerk.

Municipal Offices,
Pwllheli.
2 July, 1954. (K 388)

BOROUGH OF KIDDERMINSTER

ELECTRICAL INSTALLATIONS
RETAIL MARKET

THE Council invite tenders for the supply, delivery and erection of the complete lighting and power installations, including fluorescent and tungsten lighting fittings, in the Retail Market, High St, Kidderminster.

Specification, drawings, bills of quantities and form of tender may be obtained upon application not later than 16 July, 1954, from Messrs Winton Thorpe, Tunnadine and Partners, Consulting Engineers, 100 Victoria St, London, S.W.1, accompanied by a deposit of two guineas (returnable upon receipt of a bona fide tender).

Tenders are to be returned in sealed envelopes, endorsed "Tender—Retail Market," and addressed to the undersigned not later than 12 noon on Monday, 9 Aug., 1954. The Council do not bind themselves to accept the lowest or any tender.

J. L. EVANS,
Town Clerk.

Town Hall,
Kidderminster. (K 357)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

THE ELECTRICITY BOARD
Belize, British Honduras

ELECTRICAL ENGINEER

APPLICATIONS are invited for the appointment of an Electrical Engineer in the service of the Electricity Board, Belize, British Honduras.

The present supply system which is 110/220 V, 3-wire D.C., is to be changed over to 6,600 V and 220 V, 3-phase, 60 cycles A.C., three new 800 kW diesel-alternator sets are to be installed and two existing 400 kW diesel sets converted from D.C. to A.C.

The Engineer will be required, initially, to supervise the changeover of the distribution system from D.C. to A.C. and the erection of the generating sets, and ultimately to take charge of the operation and maintenance of the distribution system and the generating plant.

Candidates should be Corporate Members of the Institution of Electrical Engineers or hold qualifications exempting them from the Institution examination and must have had considerable experience in the construction and operation of L.V. overhead distribution networks and H.T. overhead lines up to 6,600 V. They must also have had some experience in the erection and operation of diesel engines up to 1,000 h.p.

The appointment will be on a salary scale of £900 per annum rising by annual increments of £150 to a maximum of £1,200 per annum. The point of entry into the salary scale will depend on the candidate's age, qualifications and experience. Details of Provident fund, 6%.

A car allowance of £5 per month will be paid.

The appointment will be for a period of 3 years in the first instance terminable by three months' notice on either side and may be renewable by mutual consent.

Free passages will be provided for the officer and his family up to four full passages, on first appointment, on termination of the agreement and for long leave in the United Kingdom.

Leave is earned at the rate of sixty days per year of residence in service and may be accumulated. (Earned leave to the United Kingdom may be taken after three years' service).

Applications endorsed "Electrical Engineer, Belize," stating age, qualifications and experience should be forwarded within 21 days of the date of this advertisement to the undersigned who will communicate with candidates selected for further consideration.

PREECE, CARDEW AND RIDER.
8-12 Queen Anne's Gate,
Westminster, S.W.1. (K 350)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

GENERAL ASSISTANT ENGINEER is required in the System Operation Department at Divisional Headquarters, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule "C," Grade 8, commencing in range £501 to £639, ultimately rising to £714 per annum.

Duties are of a general statistical and technical nature, associated with the group operation of power stations, and the successful applicant will be required to carry out shift duties as necessary in the System Control Room. Power Station experience and appropriate technical qualifications will be considered advantages.

Apply, quoting Vacancy No. 704MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 24 July, 1954. (K 391)

AIR MINISTRY

require MECHANICAL AND ELECTRICAL ENGINEERS in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation stations. Appointments in two grades (a) Main Grade, salary scale £1,000 to £1,320; (b) Assistant Grade £650 to £1,000. Starting pay according to qualifications and experience. Salaries somewhat lower in provinces. Candidates should be age 25 or over. Appointments temporary and non-pensionable but with long-term possibilities. Special allowance up to £1,500 a year according to location payable in addition to salary during overseas service. Candidates must be natural born British subjects of natural born British parents.

Minimum qualifications and experience for both grades of posts: (i) (a) University degree or equivalent diploma in electrical and/or mechanical engineering and at least a two-year apprenticeship or (b) Graduate or Corporate Membership of the Institutions of Mechanical or Electrical Engineers with appreciable electrical engineering experience and at least three years' apprenticeship and (ii) employment in responsible position for minimum of three years with well-established engineering concern providing wide experience in electrical and mechanical engineering practice.

Application forms quoting reference D1/54A from M.L. and N.S., Technical and Scientific Register (K), Almack Hse, King St, London, S.W.1. (K 348)

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF GENERAL ASSISTANT ENGINEER (INSTALLATION CONTRACTS)—SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, BOLTON

APPLICANTS should have experience in the preparation of schemes and estimates and the supervision of all types of installation work in industrial and commercial premises and public buildings.

Salary Scale: £616/£646 p.a. Grade L.13. N.J.B. Conditions.

Applications to the Sub-Area Manager, No. 2 Sub-Area, the North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester, 3, by 17 July, 1954.

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER, PRESTON DISTRICT

Duties will include the operation, maintenance and construction of underground and overhead mains, substations and transformers, and general mains work including standby duty. Applicants should state their experience in high voltage work. Possession of a National Certificate in Electrical Engineering will be an advantage.

Salary Scale: £697/£718 p.a. Grade F.7. N.J.B. Conditions.

Applications to the Manager, No. 4 Sub-Area, the North Western Electricity Board, 40/41 Lune St, Preston, by 17 July, 1954.

APPOINTMENT OF THIRD ASSISTANT DISTRICT ENGINEER, WHITEHAVEN DISTRICT

Applicants should be capable of preparing schemes and estimates for medium voltage extensions and of supervising construction. Possession of the H.N.C. in Electrical Engineering would be an advantage.

Salary Scale: £607/£629 p.a. Grade F.9. N.J.B. Conditions.

APPOINTMENT OF SECOND ASSISTANT ENGINEER (PLANNING AND CONSTRUCTION), SUB-AREA MAINS ENGINEER'S DEPARTMENT, KENDAL

Applicants should have wide experience in the design, survey, and construction of overhead and underground transmission and distribution systems with associated substations, operating at pressures up to 33 kV, including rural electrification. Candidates should preferably be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary Scale: £817/£852 p.a. Grade J.7. N.J.B. Conditions.

Applications for the above posts to Sub-Area Manager, No. 6 Sub-Area, the North Western Electricity Board, Castle Green, Kendal, by 17 July, 1954. (K 371)

BRITISH ELECTRICITY AUTHORITY
South Eastern Division

STATION SHIFT CONTROL ENGINEER—Croydon "A" Power Station. Applicants, who should preferably possess H.N.C. in Electrical Engineering, must have had experience in the operation and control of turbo-generators and in control room duties connected with inter-connected generating systems and E.H.T. feeder network. Class F, Grade 10, £605. 17s. including London Allowance.

JUNIOR ENGINEER (INSTRUMENTS)—Brighton "B" Power Station. Applicants should preferably possess O.N.C. and should have had experience in the maintenance, testing and calibration of all types of Power Station instruments. A knowledge of electronics would be an advantage. Class J, Grades 8/14, commencing at £402 per annum. N.J.B. conditions of service and salary for both positions. Applications, giving details of education, experience, present position, etc., should be received by the Station Superintendent at either Croydon "B" Power Station, Beddington Farm Rd, Croydon, Surrey, or Brighton Power Station, Portslade-by-Sea, according to the location of the vacancy, by 17 July. (K 382)

YORKSHIRE ELECTRICITY BOARD
No. 5 (Wakefield) Sub-Area

Doncaster District

DISTRICT ENGINEER

APPLICANTS should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications. They must be widely experienced in all branches of electricity distribution work covering Industrial, Urban and Rural Areas with underground and overhead systems.

Salary: N.J.B., Class F, Grade 3, £912/£951 per annum.

SENIOR SALES REPRESENTATIVE

Applicants must have had practical experience in negotiating with and advising Urban and Rural consumers in respect of new and increased supplies, in the sale and use of domestic, agricultural and industrial equipment, and on tariffs. They should preferably have had experience in the compilation and maintenance of consumers' records and the preparation of reports and statistics.

Applicants must hold a current driving licence.

Salary: N.J.C., Grade 2, £485/£545 per annum.

Barnsley District

ASSISTANT CONSUMERS' ENGINEER

Applicants, who must have had a sound practical training and a fair amount of experience in the work of a Consumers' Engineer, will be required to give advice to all classes of consumer concerning the utilisation of electricity. Experience in the interpretation of the I.E.E. wiring regulations and in tariffs will be of advantage. Preference will be given to applicants holding a Higher or Ordinary National Certificate in Electrical Engineering or some other approved qualification.

Salary: N.J.B., Class F, Grade 10, £577/£598 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 21 July, 1954.

No. 3 (Sheffield) Sub-Area

SENIOR DRAUGHTSMAN

Applicants should have had a sound technical education and be first class draughtsmen with drawing office experience within the electricity supply industry.

A knowledge of the design, construction and survey of overhead and underground distribution systems up to 33 kV is necessary.

The successful candidate will be responsible to the Chief Draughtsman for the preparation of plans for Mains Records and extensions, Statutory Notices and Wayleaves, and for the training of Junior Draughtsmen in this work.

Salary: N.J.B., Schedule D, Grade 5, £567/£671 per annum.

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Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield, not later than 21 July, 1954.

No. 6 (Hull) Sub-Area

Hull District

GENERAL ASSISTANT DISTRICT ENGINEER (HULL)

Applicants should have had a good general and technical education with practical training, preferably in the Electricity Supply Industry, and should be Graduate Members of the Institution of Electrical Engineers, or hold equivalent qualifications. They should have experience in the construction of overhead lines, and experience in operation and maintenance will be an advantage.

The successful applicant will be required to reside in Hull and may be required to undertake standby duties.

Salary: N.J.B., Class J, Grade 11, £639/£665 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 21 July, 1954.

No. 7 (Grimsby) Sub-Area

Scunthorpe and Gainsborough Districts

ELECTRICIANS

Required for general installation work. N.J.I.C. rate of pay and conditions of service, the present rate being 3s. 9d. per hour for a 44-hour, 5-day week.

Applications, giving full details of age, training and experience, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 21 July, 1954. (K 373)

HERTFORDSHIRE COUNTY COUNCIL
COUNTY ARCHITECT'S DEPARTMENT

ASSISTANT ELECTRICAL ENGINEER Grade 6, £695/£760. Must have passed the Final Examination of the Institution of Electrical Engineers. Previous Local Government experience not essential. Applications together with the names of three referees, to the County Architect, County Hall, Hertford, Herts, not later than first post 19 July, 1954. (K 394)

HER MAJESTY'S COLONIAL SERVICE
VACANCIES FOR SIGNALS OFFICERS AVIATION DEPARTMENT, NIGERIA

DUTIES are to maintain all aeronautical mobile telecommunications and radio navigational aid equipment at Civil Aerodromes in Nigeria and to ensure that I.C.A.O. procedures and practices are observed.

Appointment is either pensionable on probation in the salary scale £910/£1,560 or on contract in the scale £1,116/£1,898; point of entry depending on war services and approved experience. A gratuity of £100/£150 per annum is payable on satisfactory completion of contract appointment.

Free first class passages are provided for the officer and his wife, and an allowance of £75 per annum each is payable in respect of a maximum of two children. Leave is granted at rate of 7 days for each month of resident service. Government quarters if available are provided at low rental.

Candidates must be A.M.I.E.E., or have taken or be exempted from sections A and B of the examination for Associate Membership provided they attain corporate membership within 3 years, or have a 1st or 2nd class Honours degree in Engineering or Physics. Previous experience with aeronautical telecommunications equipment is desirable. A knowledge of modern theory and practice of radio and electricity and its application to air navigation, with particular reference to the procedures and other requirements of the International Civil Aviation Organisation is necessary.

Apply in writing to the Director of Recruitment, Colonial Office, Gt Smith St, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number BCD 98/14/01. (K 349)

BRITISH ELECTRICITY AUTHORITY

North West, Merseyside and N. Wales Division

VACANCY No. 112/54 — STATION SHIFT CONTROL ENGINEER, Agecroft "A" Generating Station, near Manchester. Salary £577/£598 (F.10).

Vacancy No. 113/54—FIRST ASSISTANT STATION CHEMIST, Huncoat Generating Station, near Accrington. Salary £607/£629 (F.9).

Vacancy No. 115/54 — ASSISTANT SHIFT CHARGE ENGINEERS (2), Huncoat Generating Station, near Accrington. Salary £607/£629 (F.9).

Vacancy No. 116/54 — ASSISTANT SHIFT CHARGE ENGINEER, Roosecote Generating Station, near Barrow-in-Furness. Salary £641/£667 (G.9).

Vacancy No. 118/54—STATION SHIFT CONTROL ENGINEER, Radcliffe Generating Station, near Manchester. Salary £577/£598 (F.10).

Vacancy No. 119/54—SHIFT CHARGE ENGINEER, Greenhill Generating Station, Oldham. Salary £649/£681 (E.7).

Apply, quoting Vacancy No. to Controller, British Electricity Hse, 825 Wilmslow Rd, Manchester 20, before 17 July. (K 372)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED FIRST ASSISTANT DISTRICT ENGINEER in District 347 (Cardiff East) in the Central Sub-Area.

Applicants should have experience in the construction, operation and maintenance of substations and underground and overhead high and low voltage mains in the urban and rural areas.

Salary—Class G, Grade 4 (£905/£925/£944) of N.J.B. Schedule.

Applications stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 17 July, 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. (K 408)

NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the appointment of FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, Hesledon District. Applicants should be suitably qualified electrical engineers with experience in all aspects of service to domestic, commercial and smaller industrial consumers. Salary, Schedule "A," Class E, Grade 6—£699/£725 per annum. N.J.B. conditions of service.

Applications stating age, qualifications and experience should be forwarded to the Secretary (Establishments), the North Eastern Electricity Board, G.P.O., Box No. 117, Carliol House, Newcastle-upon-Tyne 1, within seven days of the appearance of this advertisement. (K 397)

BRITISH ELECTRICITY AUTHORITY

Yorkshire Division

APPLICATIONS are invited for appointments as DEPUTY STATION SUPERINTENDENTS at

(a) Neepsend Power Station, Sheffield, and

(b) Huddersfield Power Station.

Salary (a) £1,035/£1,081 p.a., Class H, Grade 3, N.J.B. Agreement. (b) £912/£951 p.a., Class F, Grade 3, N.J.B. Agreement.

Applicants for both appointments should have had a good technical education and practical experience in the operation, maintenance and administration of a modern power station. Preference will be given to candidates who are Corporate Members of the Institution of Mechanical Engineers and/or Institution of Electrical Engineers.

Application forms obtainable from the Divisional Secretary (Establishments), British Electricity Hse, St. Mary's Rd, Leeds 7, to be returned within 14 days of the appearance of this advertisement.

G. A. VOWLES,
Divisional Controller.
(K 387)

DIESEL-ELECTRIC MECHANICS

required by the FALKLAND ISLANDS DEPENDENCIES SURVEY for service in the Antarctic for a tour of 18 or 30 months in the first instance. Salary in scale £330 rising to £420 a year. Free passages, quarters, subsistence, clothing and liberal canteen stores; it is possible to save almost all emoluments. Liberal leave on full salary. Candidates between 20-26 years must have a general working knowledge of electricity and be capable of running and maintaining small diesel generating sets with associated switchboards, accumulators, etc. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30413/EE. (K 400)

THE BELMOS COMPANY LIMITED

Bellshill, Lanarkshire

RESEARCH ENGINEERS

APPLICATIONS are invited for appointments to the Staff of a research unit for work on problems associated with Control Gear, Contactors, and Low-voltage Switchgear. Candidates should have a good honours degree, and have completed a period of post-graduate industrial training. Preference will be given to those who have had some experience in an appropriate field of engineering or in experimental research.

Salaries will be commensurate with qualifications and experience, which should be stated in letters of application addressed to the Managing Director. (K 304)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED DISTRICT ENGINEER in District 101/2 (Haverfordwest) in the Western Sub-Area.

Salary—Class D, Grade 2 (£894/£925) of N.J.B. Schedule.

Applications stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 17 July, 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. (K 404)

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.MECH.E. an advantage.

JUNIOR ENGINEERS (CONTROL)
BANKSIDE GENERATING STATION
Vacancy No. 54/526

Duties include assisting in Main Control Room, with opportunity for gaining general knowledge of Power Station. Shift duties. Salary—Class H, Grade 15/3=£473 p.a.

JUNIOR ENGINEER
HACKNEY GENERATING STATION
Vacancy No. 54/527

Good technical training with Generating Station experience desirable. General duties in Station operation. Salary—Class F, Grade 14/3=£491 p.a.

STATION SHIFT CONTROL ENGINEER
ST. MARYLEBONE GENERATING STATION
Vacancy No. 54/528

Practical experience in Control Room Operation necessary. Salary—Class E, Grade 10=£582. 15s. p.a.

GENERAL ASSISTANT ENGINEER
(ASSISTANT SECTION ENGINEER)
TRANSMISSION DEPARTMENT
Vacancy No. 54/529

Candidates should have a wide experience in operation and maintenance of high voltage transmission equipment. Salary—N.J.B. Schedule C, within range Class AX, Grade 6, £613. 4s./£756 rising to ultimate maximum Class EX, Grade 6, £849. 9s. p.a.

Applications quoting Vacancy Number may be made on form from Divisional Secretary, British Electricity Authority, London Division, Generation Hse, Great Portland St, W.1, and be received within 14 days of this advertisement. (K 403)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

SENIOR ASSISTANT ENGINEER (Civil) is required in the Chief Generation Engineer's (Construction) Department at Divisional Headquarters. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 1, commencing in range £970 to £1,103, ultimately rising to £1,198 per annum.

Applicants should be experienced in the design and construction of heavy foundations, structural steel and ferro-concrete frames, and building works associated with modern power stations including office blocks, canteens, and similar structures. The work also involves the preparation of specifications, the examination of tenders, the supervision of contracts and approval of contractors' designs. Applicants should preferably be corporate members of the Institute of Civil Engineers or hold equivalent qualifications.

Apply, quoting Vacancy No. 703MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 24 July, 1954. (K 393)

THE EAST AFRICAN POWER AND LIGHTING CO. LTD.

require for service in Kenya, a TECHNICIAN experienced in the installation and maintenance of Power Line carrier current equipment. The successful applicant will be expected to work also on electronic voltage regulators, communication systems and power system protective circuits, etc., but he need not necessarily have had previous experience of these provided he is willing to learn.

Salary £720 p.a. plus marriage allowance £100 p.a. (if applicable).

Cost of living allowance up to approximately £90 p.a. Free housing or allowance of 20% of basic salary in lieu. Free medical attention and electricity and contributory Pension Scheme.

Apply to the East African Power and Lighting Co., Ltd., 66 Queen St, London, E.C.4. (K 364)

BRITISH ELECTRICITY AUTHORITY

North Eastern Division

STELLA NORTH AND SOUTH POWER STATIONS

APPLICATIONS are invited for the following appointments which will be made during the present year:

1. STELLA SOUTH POWER STATION, BLAYDON-ON-TYNE

(a) Deputy Station Superintendent, Grade 3, Class K (£1,182/£1,233).

(b) Operation and Efficiency Engineer, Grade 5, Class K (£1,003/£1,047).

(c) Maintenance Engineer (Mech.), Grade 6, Class K (£936/£977).

(d) 5 Shift Charge Engineers, Grade 7, Class K (£869/£907).

(e) Station Chemist, Grade 7, Class K (£869/£907).

2. STELLA NORTH POWER STATION, NEWBURN-ON-TYNE

(a) Deputy Station Superintendent, Grade 3, Class J (£1,104/£1,156).

(b) Operation and Efficiency Engineer, Grade 5, Class J (£942/£983).

(c) Maintenance Engineer (Mech.), Grade 6, Class J (£883/£918).

(d) 5 Shift Charge Engineers, Grade 7, Class J (£817/£852).

(e) Station Chemist, Grade 7, Class J (£817/£852).

Applicants for appointments (a) and (b) should have had wide experience in the operation, maintenance and administration of Power Stations, and those for (c) and (d) previous experience in a large Power Station.

Applicants for appointment (e) should possess an A.R.I.C. or equivalent qualification.

Forms of application may be obtained from Divisional Establishments Officer, British Electricity Authority, North Eastern Division, Carliol Hse, Newcastle-upon-Tyne, 1, to whom they should be returned to arrive not later than 21 July, 1954. (K 409)

CITY OF WAKEFIELD
City Engineer's Department
ASSISTANT ELECTRICAL ENGINEER, GRADE A.P.T.II.

APPLICATIONS are invited for the above superannuable appointment on Grade A.P.T. II (£520/£565) commencing at £520.

Applicants must have obtained the Ordinary National Certificate (Electrical Engineering) and have had experience in the design and supervision of electrical installations in houses, schools, etc.

Applications, endorsed "Assistant Electrical Engineer", and giving details of experience and past and present appointments, along with the names of two referees, to be sent to me not later than 21st July, 1954.

W. S. des FORGES,
Town Clerk.

Town Hall, Wakefield. (K 420)

POWER STATION SUPERINTENDENT

required by the GAMBIA GOVERNMENT for two tours of 18 months each in the first instance. Salary scale (including expatriation pay) £798 rising to £1,263 a year. Gratuity at the rate of £100 a year. Liberal leave on full salary. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £72 annually for maintenance in U.K. Candidates should have served an apprenticeship with Turbo pressure charged Diesels and must have subsequent electrical and mechanical experience in Diesel power stations including parallel operation of sets. An H.N.C. would be an advantage. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30633/EE. (K 359)

SOUTHERN ELECTRICITY BOARD
INSTALLATION ASSISTANT

BASINGSTOKE District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class D, Grade 11, Column 1 (£500 per annum). N.J.B. Conditions of Service.

Applicants should have had experience in the preparation of specifications and estimates for all types of electrical wiring installations and should be competent to supervise electricians and organise allocation of work.

The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him not later than 23 July, 1954. (K 402)

BRITISH ELECTRICITY AUTHORITY
Southern Division
S-/13-/548

APPLICATIONS are invited for the following position, ASSISTANT SHIFT CHARGE ENGINEER, Swindon Generating Station. Applicants must have had previous experience in a modern generating station. Manufacturing works experience will be an advantage. Preference will be given to those who possess qualifications and experience relating to corporate membership of a recognised professional institution or who are studying for the examinations of an institution.

Salary N.J.B. Class E, Grade 9 (£587/£600).

Special application forms obtainable from P. D. A. Oliver, Divisional Secretary, High St, Portsmouth, should be returned not later than 21 July, 1954. (K 412)

NORTH EASTERN ELECTRICITY BOARD
Wear Sub-Area

APPLICATIONS are invited for the appointment of THIRD ASSISTANT DISTRICT ENGINEER, Durham District. Salary—Schedule A, Class F, Grade 9—£607/£629 per annum. N.J.B. conditions of service.

Applications stating age, qualifications and experience, should be forwarded to the Secretary (Establishments), the North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle-upon-Tyne 1, within seven days of the appearance of this advertisement. (K 396)

ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS
ASSISTANT SECRETARY (EDUCATION AND TECHNICAL)

APPLICATIONS are invited for the above position on headquarters staff of the Association. Salary from £800 per annum, according to qualifications and experience. Experience in electrical engineering and ability to organise educational activities essential; experience in editorial and committee work an advantage.

Written applications should be sent to the General Secretary, 23 Bloomsbury Sq, W.C.1, not later than Saturday, 24 July, in envelopes endorsed "Assistant Secretary." (K 362)

ESSEX EDUCATION COMMITTEE
South East Essex Technical College
Longbridge Road, Dagenham

REQUIRED September (or as soon as possible after) ASSISTANT, Grade B, for Electrical Engineering subjects. Salary (under review): £490 by £25—£765 (man), plus degree (or equivalent) and training additions, and increments for previous recognised experience.

Further details and form from Clerk to Governors (S.A.E.). (K 410)

THE SOUTH WALES ELECTRICITY BOARD

APPLICATIONS invited for positions of COMMERCIAL ASSISTANT in the following districts of the Western Sub-Area:

District 104—Lampeter
District 105—Llandilo

Applicants must have had experience in the application of electricity to domestic and commercial premises and all general purposes.

Salary—Class C, Grade 10 (£502/£512/£521) of N.J.B. Schedule.

Applications stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 17 July, 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. (K 407)

BRITISH ELECTRICITY AUTHORITY
Southern Division
S/13.547

APPLICATIONS are invited for the following position:
ASSISTANT SHIFT CHARGE ENGINEER
POOLE GENERATING STATION

Applicants should have had previous experience in a large modern generating station and preference will be given to those with experience of high operating temperatures and pressures, and pulverised fuel equipment. Manufacturing works experience will be an advantage.

Preference will be given to those who possess qualifications leading to corporate membership of a recognised professional institution.

Salary N.J.B. H/9, £680/£706.

Special application forms, obtainable from P. D. A. Oliver, Esq., Divisional Secretary, 111 High St, Portsmouth, should be returned by 21 July, 1954. (K 390)

KUWAIT OIL CO. LTD.

require an ASSISTANT RADIO ENGINEER for service in Kuwait on the operation, maintenance and repair of marine and land radio communication equipment. Candidates must possess B.SC. in electrical engineering or membership of the Institution of British Radio Engineers or Electrical Engineers, in addition have Industrial experience on V.H.F. production development and be able to deal with all types of low and medium-powered transmitters and receivers. Knowledge of hospital and other electronic equipment an advantage. Age under 35. Salary starting £830 p.a. clear plus generous allowances, Pension Scheme and kit allowance. Write for application form giving brief details and quoting K.1808 to Box D/67, c/o 191 Gresham Hse, E.C.2. (K 361)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED SENIOR FEMALE DEMONSTRATOR, District 223 (Swansea) in the West Central Sub-Area.

Duties will include the demonstration of cookery and electrical appliances in showrooms, residences, and at demonstrations, showroom duties and supervision of other Demonstrators.

Salary—Grade 2 (£485/£545) of N.J.C. Schedule.

Applications stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 17 July, 1954.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. (K 405)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

SENIOR ASSISTANT ENGINEER (Mechanical) is required in the Chief Generation Engineer's (Construction) Department at Divisional Headquarters. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 1, commencing in range £970 to £1,103, ultimately rising to £1,198 per annum.

Duties will consist of the preparation of designs and layout of mechanical equipment for power stations, particularly with regard to turbo-alternators and condensing plant, feed heating equipment, boilers, high pressure steam and feed piping, coal and ash handling plants, and ancillary equipment. The work also involves the preparation of specifications, the examination of and reporting on tenders, the supervision of contracts and approval of contractors' designs, site erection and commissioning. Applicants should preferably possess a university degree in mechanical or electrical engineering or be corporate members of the Institute of Mechanical and/or Electrical Engineers.

Apply, quoting Vacancy No. 702MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 24 July, 1954. (K 392)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following post:
SHIFT CHARGE ENGINEER
RYE HOUSE GENERATING STATION

Salary Class G, Grade 7, £729/£758 per annum.

Applicants should preferably have served an apprenticeship and obtained a recognised qualification in Electrical or Mechanical Engineering and possess experience in the operation of a Generating Station fired with pulverised fuel.

Applications giving age and details of qualifications and experience, should be submitted to the Controller, British Electricity Authority, Eastern Division, Northmet Hse, Southgate, N.14, to arrive not later than 17 July, 1954.

W. N. C. CLINCH,
Controller.
(K 399)

INSTRUCTOR
Electrical Trades

required for the GOVERNMENT TECHNICAL INSTITUTE, BRITISH GUIANA, on contract for three years in first instance. Salary scale equivalent to £675 rising to £950 a year (including present temporary allowance of £50 a year). Gratuity of 22½% of basic salary drawn during contract. Free passages. Liberal leave on full salary. Candidates must hold appropriate C. and G. Full Technological Certificate or H.N.C. and have at least 5 years' industrial experience including electrical installation work. Teaching experience is desirable. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/30229/EE. (K 360)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

MIDDLESEX COUNTY COUNCIL

COUNTY ARCHITECT'S DEPARTMENT

ELECTRICAL ENGINEERING ASSISTANT required. Salary APT IV (£580/£625 p.a. plus London weighting). Appointment at grade minimum, established and pensionable subject to medical assessment and prescribed conditions. Should have served apprenticeship or had practicable experience in wiring installation work and have been employed on design of electrical services for schools or other large buildings. Required to work with minimum supervision. Application forms (stamped addressed foolscap envelope) from County Architect, 1 Queen Anne's Gate Buildings, Dartmouth St, S.W.1, returnable by 19 July. (Quote N.745 ET). Canvassing disqualifies. (K 401)

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER
SUTTON DISTRICT

SALARY £466 p.a. under N.J.B. Class F, Grade 13, plus London Allowance. Superannuable. Applicants should have had a good general education and technical training up to Higher National Certificate standard or equivalent. Experience in distribution work and E.H.V. and L.V. supply is essential.

Applications on forms from C. W. Emanuel, M.I.E.E., Sutton Manager, SEEBoard, 52 High St, Sutton, Surrey, to be returned naming 2 referees by 21 July, 1954.

A. L. BURNELL,
Secretary.
(K 395)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

TWO ENGINEERING DRAUGHTSMEN (CIVIL)
CONSTRUCTION DEPARTMENT
Vacancy No. 1/54/ET

Candidates should have experience in the preparation of detail drawings and in the design of one or more of the following subjects:

Reinforced concrete structures.

Piled and slab foundations for heavy components.

Cable subways, Bridges and Culverts.

The salary will be in accordance with Grade 4 (£671/£780 per annum) or Grade 5 (£567/£671 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications 22 July, 1954.

TWO ENGINEERING DRAUGHTSMEN
(MECHANICAL)
CONSTRUCTION DEPARTMENT
Vacancy No. 2/54/ET

Candidates should have experience in one or more of the following:

(i) Design and layout of Power Station equipment, including turbo-alternators, boiler plant, coal and ash plant and general station auxiliaries.
(ii) H.P. and L.P. steam and feed pipework. Condensing plant and feed heating systems.
(iii) Conveyor plant, coal handling systems and material handling of station auxiliary equipment.

The salary will be in accordance with the National Joint Board Agreement Grade 4 (£671/£780 per annum) and Grade 5 (£567/£671 per annum) of Schedule D according to experience.

Closing date for receipt of applications 22 July, 1954.

FOUR ENGINEERING DRAUGHTSMEN
(ELECTRICAL)
CONSTRUCTION DEPARTMENT
Vacancy No. 3/54/ET

Candidates should have experience in the preparation of layouts and diagrams for the installation of E.H.T. and L.T. switchgear, transformers, E.H.T. and L.T. cables; knowledge of protective gear systems would be an advantage.

The salary will be in accordance with the National Joint Board Agreement, Grade 4 (£671/£780 per annum) and Grade 5 (£567/£671 per annum) of Schedule D according to experience.

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Closing date for receipt of applications 22 July, 1954.

OPERATION AND EFFICIENCY ENGINEER
DRAKELOW POWER STATION
NEAR BURTON-ON-TRENT
Vacancy No. 95/54/ET

Candidates should have wide experience of the operation and maintenance of a large Generating Station with P.F. Boiler Plant. The successful applicant will be responsible to the Station Superintendent for ensuring that all sections of the plant attain the specified efficiency and for the carrying out of special investigations and tests.

Corporate Membership of the Institution of Mechanical Engineers and/or Institution of Electrical Engineers is desirable.

Salary for this appointment will be within Class J, Grade 6 (£883/£918 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 19 July, 1954.

ASSISTANT SHIFT CHARGE ENGINEER
SPONDON POWER STATION
Vacancy No. 96/54/ET

Applicants should possess the Higher National Certificate or its equivalent and have had experience in a responsible position in a Modern Generating Station.

The salary will be in accordance with Class H, Grade 9 (£680/£706 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 19 July, 1954.

These appointments will be pensionable within the terms and conditions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. J. JEFFREY,
Divisional Controller.
2 July, 1954. (K 398)

SOUTH WEST SCOTLAND ELECTRICITY BOARD
Clyde Sub-Area

THIRD ASSISTANT DISTRICT ENGINEERS required for the Clydebank District. Salary Scale Class G, Grade 9, £641/£667 per annum. Corporate Membership of the Institution of Electrical Engineers or the possession of the Higher National Certificate or an equivalent qualification would be an advantage. Applicants should have some experience of both H.V. and L.V. underground and overhead distribution systems, including switchgear. Applications should be forwarded to the Manager, The South West Scotland Electricity Board, Clyde Sub-Area, 206 St. Vincent St, Glasgow, C.2, within 10 days of the appearance of this notice. (K 386)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED CHARGEHAND LINESMAN based at Lampeter in the Western Sub-Area.

Wages and conditions in accordance with the N.J.I.C. Agreement—3s. 9d. per hour—44-hour week.

Applications giving details of present employment and previous experience should be addressed to the undersigned to arrive by 17 July, 1954. D. G. GWYN,
Sub-Area Manager.
South Beach Pavilion,
Tenby. (K 406)

BRITISH ELECTRICITY AUTHORITY
South Wales Division
Vacancy No. 68/54

APPLICATIONS invited for superannuable N.J.B. appointment of SHIFT CHARGE ENGINEER at Llanelly Power Station. Salary E.7, £649/£681 per annum.

Applicants should preferably have obtained H.N.C. and served a regular apprenticeship. Operating experience in a power station essential.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 24 July, 1954.
2 July, 1954. (K 411)

FOR AUSTRALIA

CABLE INSTALLATION ENGINEERS

ASSISTANT ENGINEERS required for cable installation work for permanent service in Australia with large Cable Manufacturing and Contracting Company. Salary according to qualifications and experience. Applicants will receive a period of training in the United Kingdom before appointment confirmed. Apply stating age, qualifications and experience to:

Box No. 3657, Electrical Times. (K 344)

A MAJOR British Oil Company requires for its overseas service an ELECTRICAL ENGINEER who would be responsible to Chief Electrical Engineer for installation of Generating and Distributing Plant, Switchgear, Motors, etc., and operation/maintenance thereof. Applicants must have served a recognised apprenticeship and hold H.N.C. or equal. Single men not over 28 preferred. Attractive salary, currently augmented by cost of living allowance; kit allowance; medical attention; pension fund; free furnished quarters and passages. Write stating age, qualifications and full details of training and experience to—Box E.T. 946, c/o 191 Gresham Hse, E.C.2. (K 379)

ALKALINE BATTERIES LTD., of Redditch, are the largest makers in the Empire of Alkaline accumulators, miners' lamps and emergency lighting systems, which are in rapidly growing use particularly for export. The company has vacancies in its Technical Sales and Development Sections for Graduate ELECTRICAL ENGINEERS, not over 30 years of age, or for men nearing the end of their Degree Course who have completed National Service. The posts are pensionable and offer the prospect of executive rank. Applications with full educational details and experience should be addressed to Commercial Manager, Alkaline Batteries Ltd., Union St, Redditch. (K 23)

A SALES REPRESENTATIVE required for Midlands Area by Manufacturers of Electrical Domestic Appliances. Applicants must reside in the Area and state age, experience and salary required.—Box No. 3661, Electrical Times. (K 354)

AN opportunity occurs in progressive manufacturing concern in London area for ENGINEER aged 25/35 with electrical or physicist degree, on development and research work on high frequency telecommunication cable and associated testing equipment. Salary will be commensurate with qualifications and experience. Apply giving full particulars to—Box No. 3641, Electrical Times. (K 321)

A CABLE Manufacturer requires a PROCESS ENGINEER for its Plastic and Rubber Section. Experience in the extrusion of PVC materials is essential and an Engineering training to National Certificate Standard would be an advantage. This post would suit a young man with drive and imagination, willing to work hard. House assistance offered. Apply—Box No. 3667, Electrical Times. (K 415)

BRITISH WEST AFRICA—Large firm requires SALESMAN for Domestic and Commercial/Industrial Electrical Appliances Department in British West Africa. Practical sales experience and some technical knowledge essential. Age 28/30 years. Pension scheme, free accommodation, good leave with free passages. Apply giving full details of previous experience and whether married or single.—Box No. 3659, Electrical Times. (K 353)

DRAUGHTSMEN AND DESIGNERS, preferably with experience of mechanism or sheet metal work or electrical switchgear or control gear. Modern factory; good conditions; A.E.S.D. rates or above, according to experience and qualifications. Apply in writing to Mr Thomson, the Belmos Co., Ltd., Industrial Estate, Blantyre, Lanarkshire. (K 365)

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The J. Stone Group of Companies, which has extensive and expanding interests in electrical and mechanical engineering, offers Permanent Positions on its Research and Development Staff to:

(a) DESIGN AND LABORATORY ASSISTANTS for development of light electrical and mechanical equipment, with prospects of advancement later to technical or sales staff overseas. Previous design experience not essential, but applicants should be of degree standard, and have had works experience.

(b) SENIOR DRAUGHTSMEN dealing with light mechanical and electrical equipment, especially dynamo-electrical machinery, automatic control gear, and mechanical drives. Works experience essential. O.N.C. or H.N.C. preferred.

Applications in first instance giving full details training, etc., to:

Personnel Manager,
J. Stone and Co. (Deptford) Ltd.,
Arklow Road, London, S.E.14.

(K 385p)

B.B.C. requires ELECTRICAL ENGINEER with technical degree or equivalent qualification and practical training and experience in industry. Good technical and practical knowledge of switchgear, transformers, rectifiers, A.C./D.C. motors and generators, contactor and control gear, batteries, cables, etc., is essential. Knowledge of diesel engine equipment and of products of leading electrical manufacturers an advantage. Duties include estimating, specification writing, examining and summarising tenders. Salary £870 or £645 rising by 5 annual increments to max. £1,175 or £880 p.a. Applications to E.E.O., B.B.C. London, W.1, within 7 days quoting ref. E.954 E.T. (K 351)

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DRAUGHTSMAN required for transmission tower drawing office. Must be neat and efficient and have had experience and knowledge of electrical control equipment and circuits. Structural experience though an advantage would not be necessary for the work involved. Apply in writing to J. G. Davies, Chief Electrical Engineer, Blaw Knox Ltd., 90/94 Brompton Rd, London, S.W.3. (K 363)

ELECTRICIAN with sound industrial experience required for installation work of an interesting nature.—Apply A. C. Dibley and Co., Ltd., 72 Granville Rd, Cricklewood, N.W.2. (K 367)

ELECTRICAL DRAUGHTSMAN required for design of work's sub-stations, H.T. and L.T. distribution systems, lighting layouts, etc. Apply, giving full details of age, training, experience and technical qualifications to The Lancashire Steel Corporation Ltd, Irlam Works, Irlam, Manchester. (K 421)

ELECTRICAL AND MECHANICAL DRAUGHTSMAN wanted for manufacturing Electrical Engineers, West London District, state age, experience and salary.—Box No. 3669, Electrical Times. (K 416)

ELECTRICAL DRAUGHTSMAN required for Persian Gulf by large Oil Company. Applicants should be under 35, with National Certificate and experienced in power and lighting installation drawing for industrial and domestic buildings, layout of L.T. and E.H.T. networks, and preferably preparation of Bills of Materials. Pensionable emoluments from £900 (incremental) plus substantial local living allowance, paid home leave (with passages) and at present no income tax. Bachelors preferred as no married accommodation available for first contract. Write, giving details and quoting No. 452 to—Box No. 7808, c/o Charles Barker and Sons Ltd., 31 Budge Row, London, E.C.4. (K 383)

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LAYOUT DRAUGHTSMEN required by Consulting Engineers for electrical layout work including H.V. and L.V. outdoor substations, indoor switchgear and cable diagrams.

Applicants should possess or should be studying for H.N.C. or equivalent. Salary in accordance with qualifications. Apply in writing reference KJB/RFS to Messrs Kennedy and Donkin, 12 Caxton St, Westminster, London, S.W.1. (K 378)

IMPERIAL CHEMICAL INDUSTRIES LIMITED
Alkali Division
Northwich, Cheshire

has a vacancy for an Electrical Engineer for work on design and later on the maintenance of generating plants and distribution networks. Candidates, age 25-35, should possess a good degree in Electrical Engineering and have had sound workshop experience. Starting salary according to age and experience. Applications giving details of age and experience should be addressed to the Staff Manager, Imperial Chemical Industries Ltd., Alkali Division, P.O. Box No. 7, Northwich, Cheshire. (K 380p)

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REPRESENTATIVES with established connections amongst Electrical Retailers required. Commission basis.—Box No. 3633, Electrical Times. (K 260)

SENIOR DRAUGHTSMEN required for switchgear and control gear. Candidates for these positions should be experienced, and preferably hold the H.N.C. Five-day week, good canteen and other welfare facilities. Non contributory pension scheme. Apply to Personnel Dept., George Ellison Ltd., Perry Barr, Birmingham 22B. (K 414)

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Reply stating past experience, age, number in family and salary expected, in strict confidence, to Managing Director.—Box No. 3663, Electrical Times. (K 355)

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with good technical qualifications required for 80 MW industrial power station. Age not less than 30. Commencing salary £950 to £1,000, with generous non-contributory pension scheme. Up-to-date and responsible power station experience essential. Apply in writing to Salaried Personnel Department, Ford Motor Company, Limited, Dagenham, Essex, quoting reference PHE. (K 370p)

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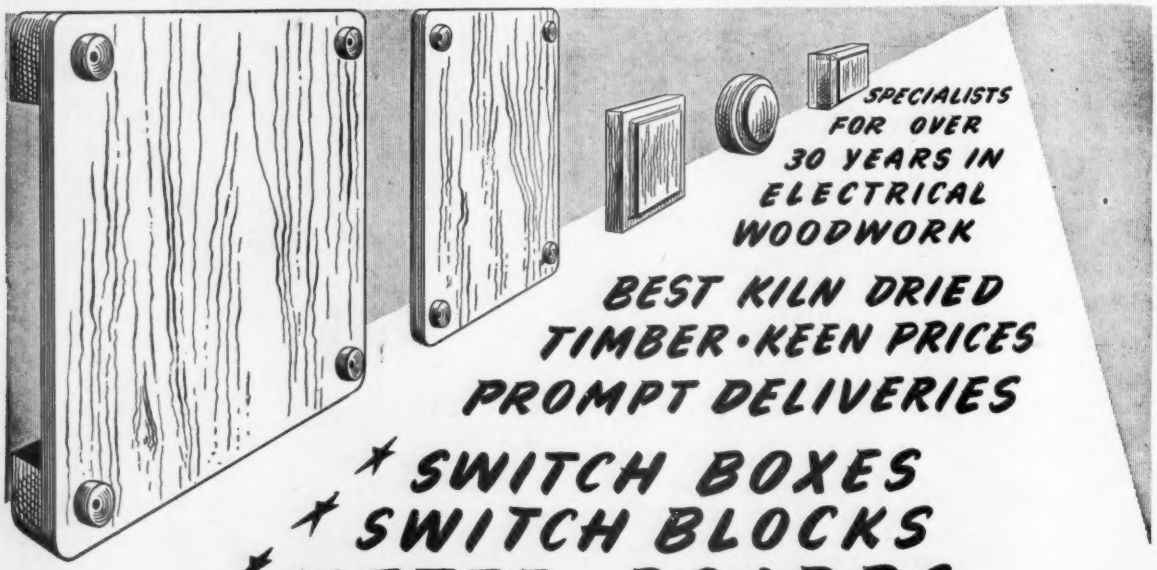

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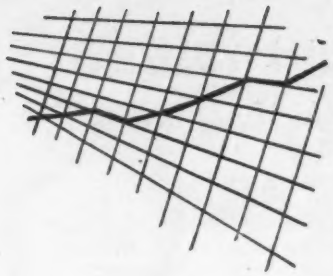

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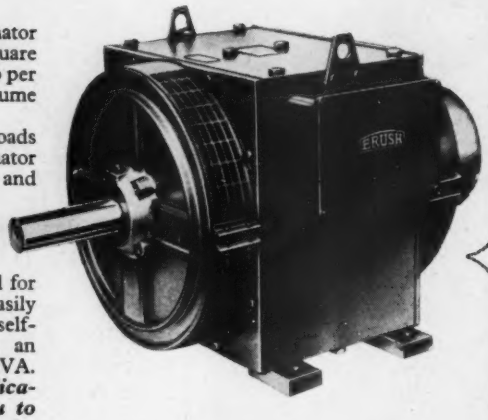

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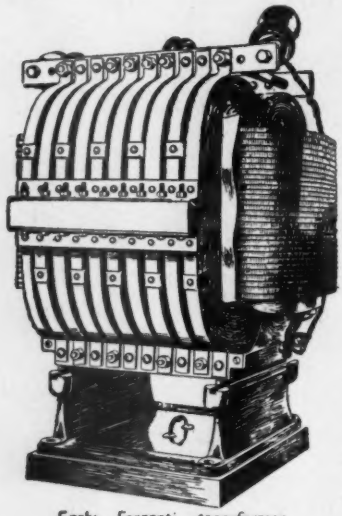

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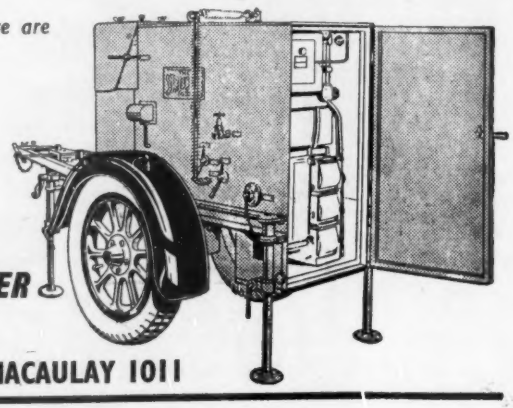

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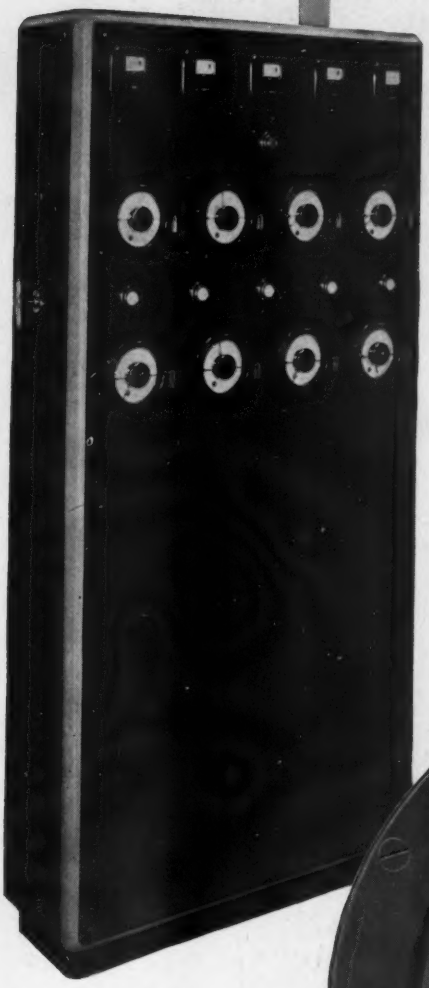

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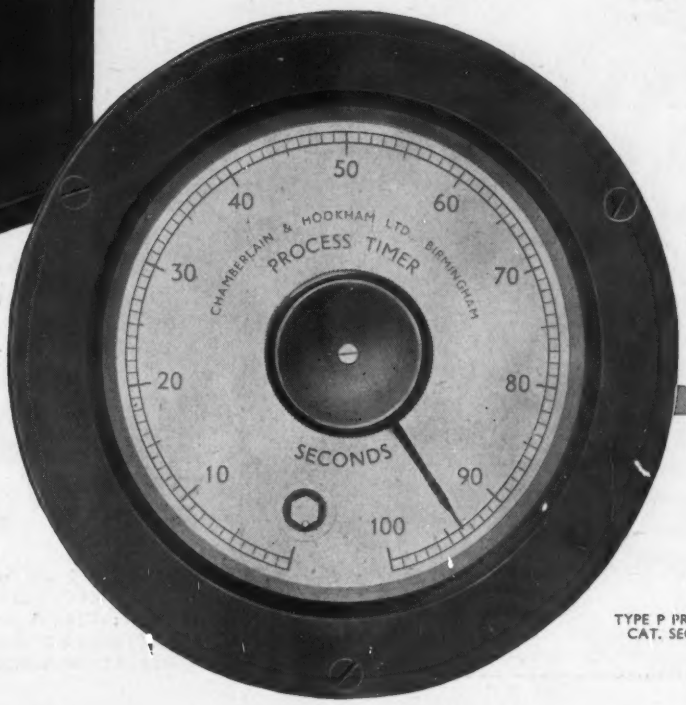

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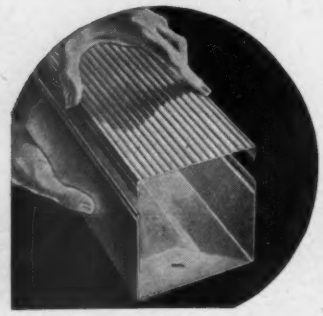

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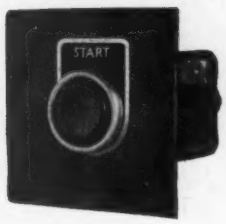

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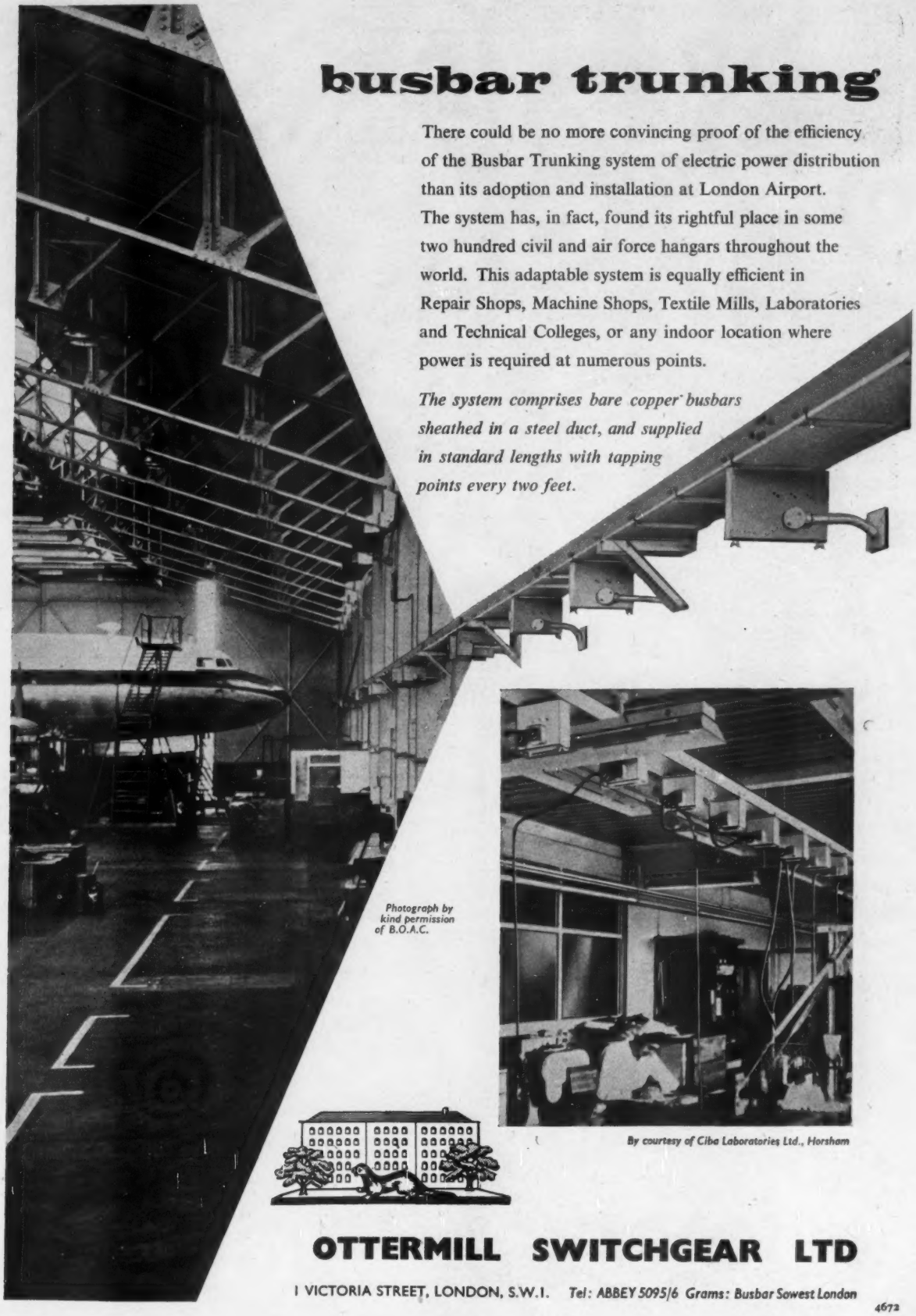

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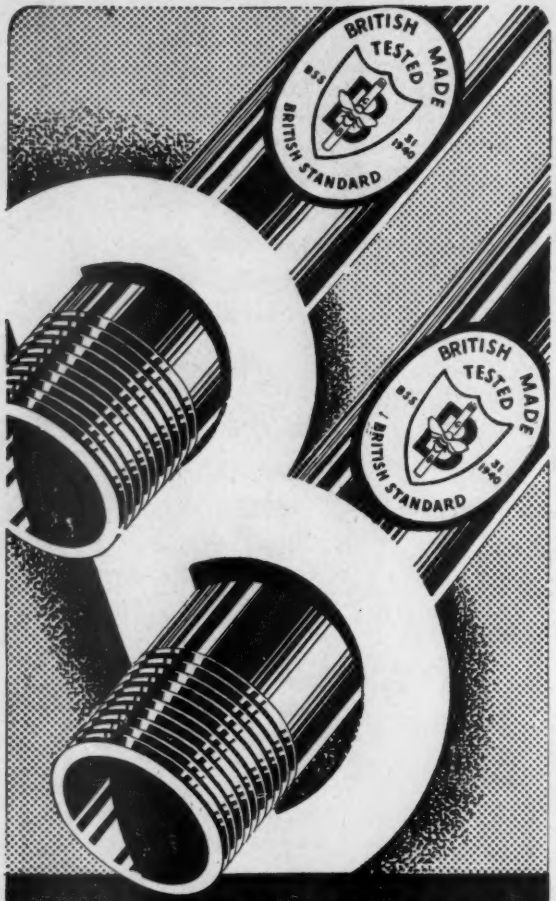

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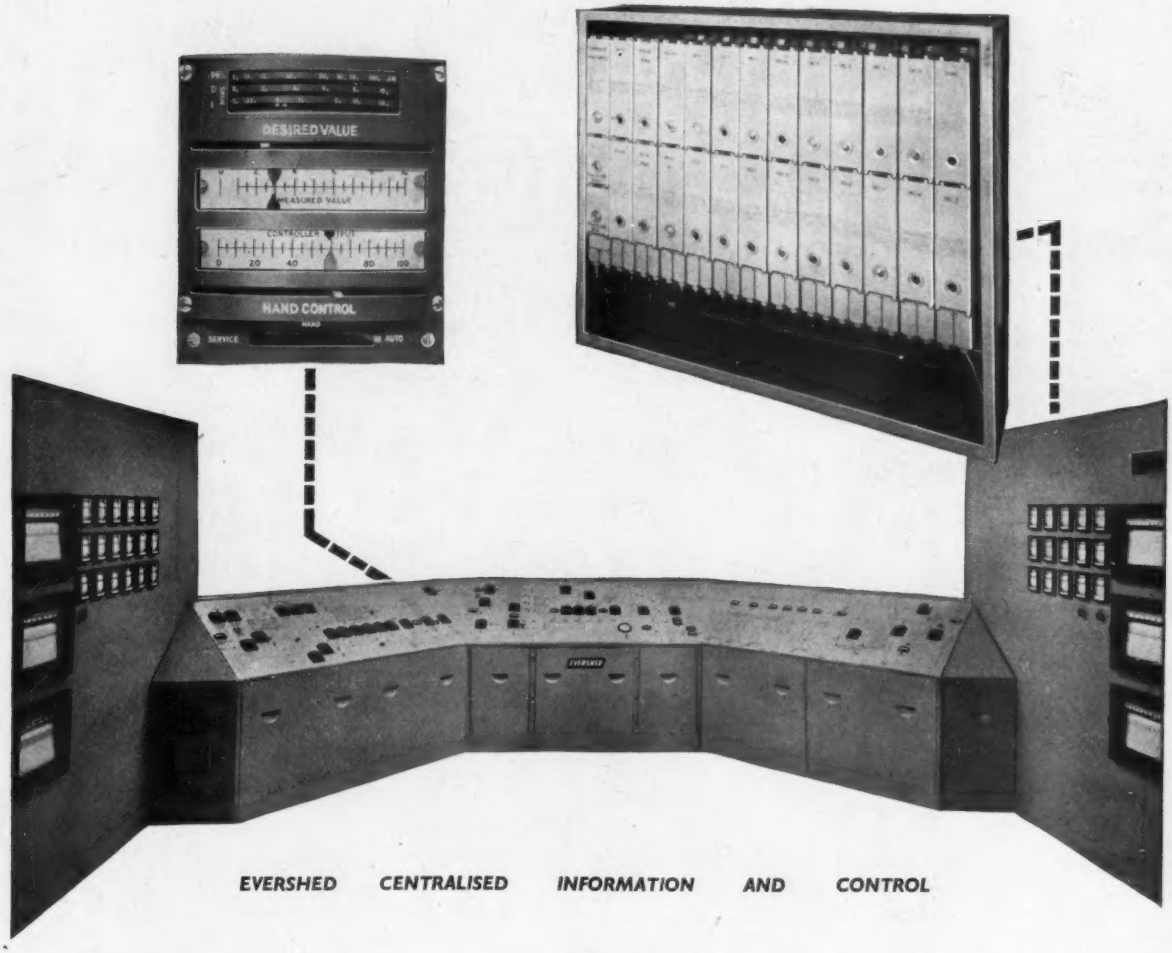

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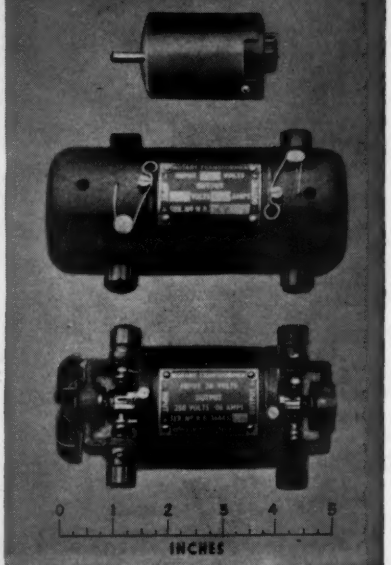

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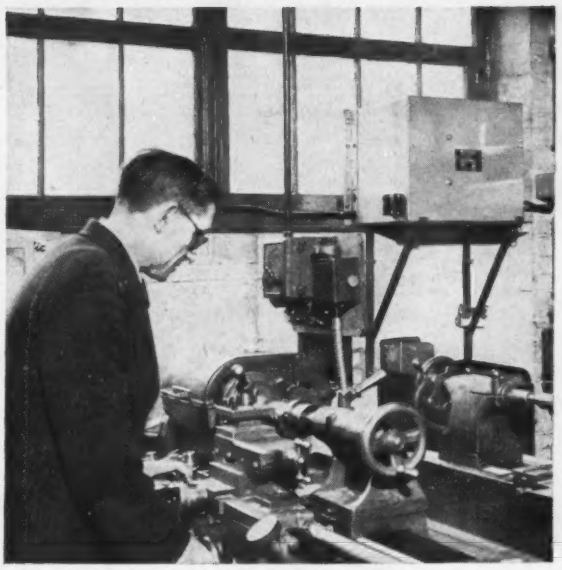

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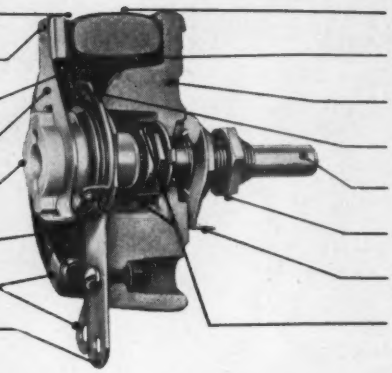

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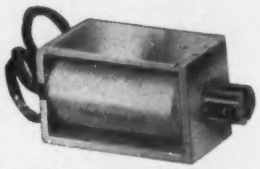

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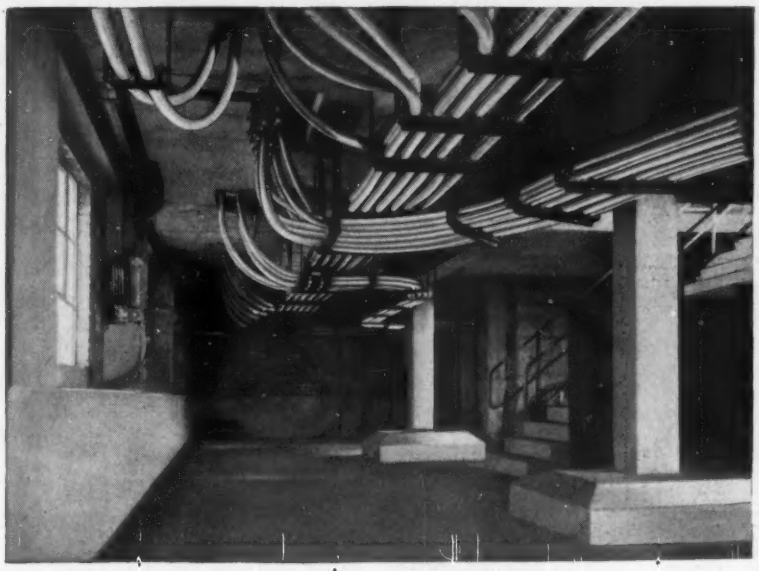

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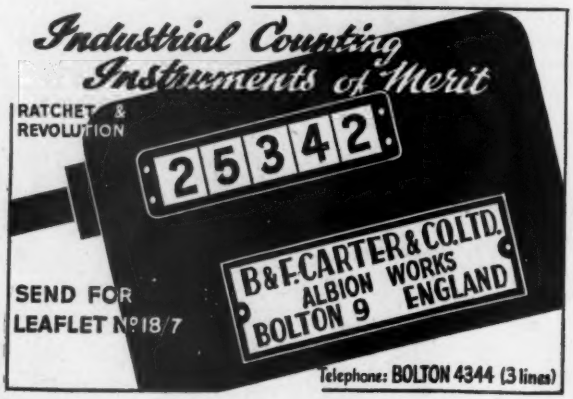

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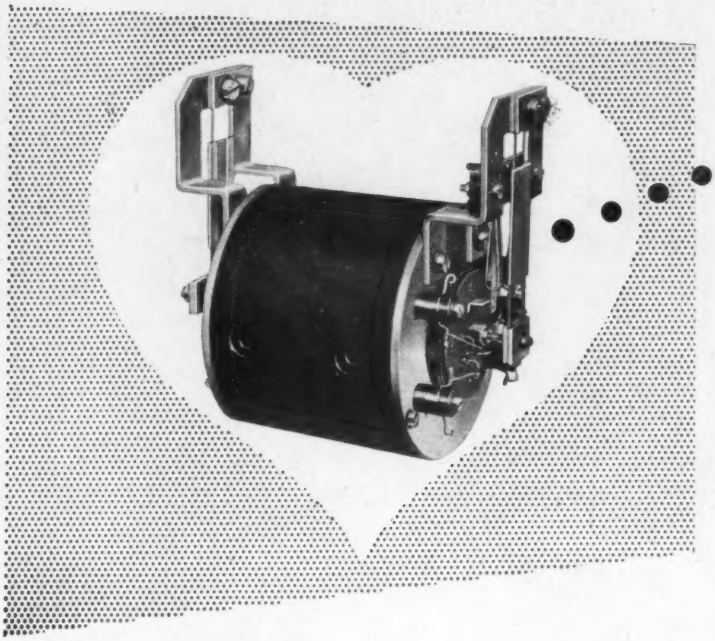

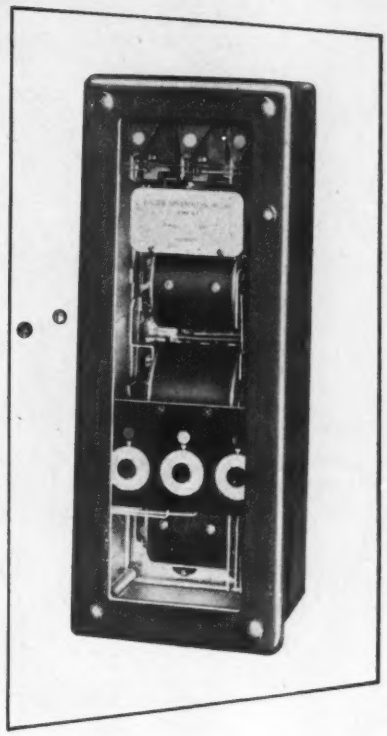

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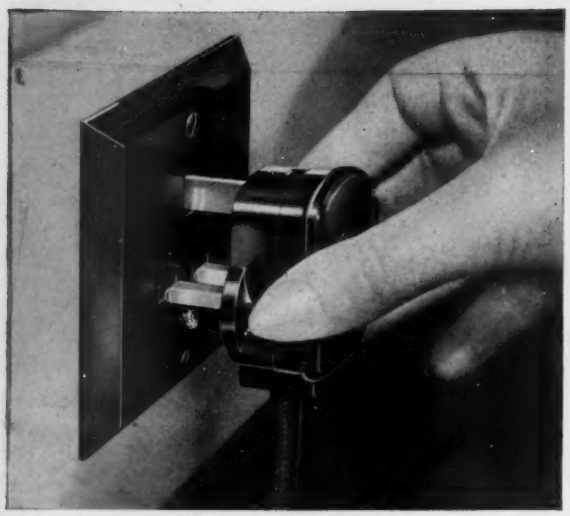

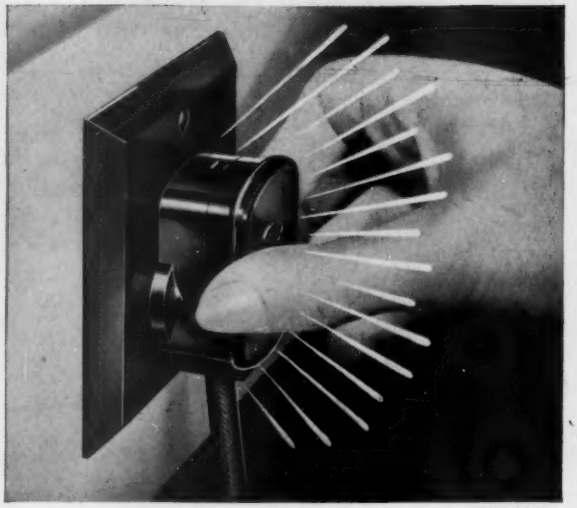

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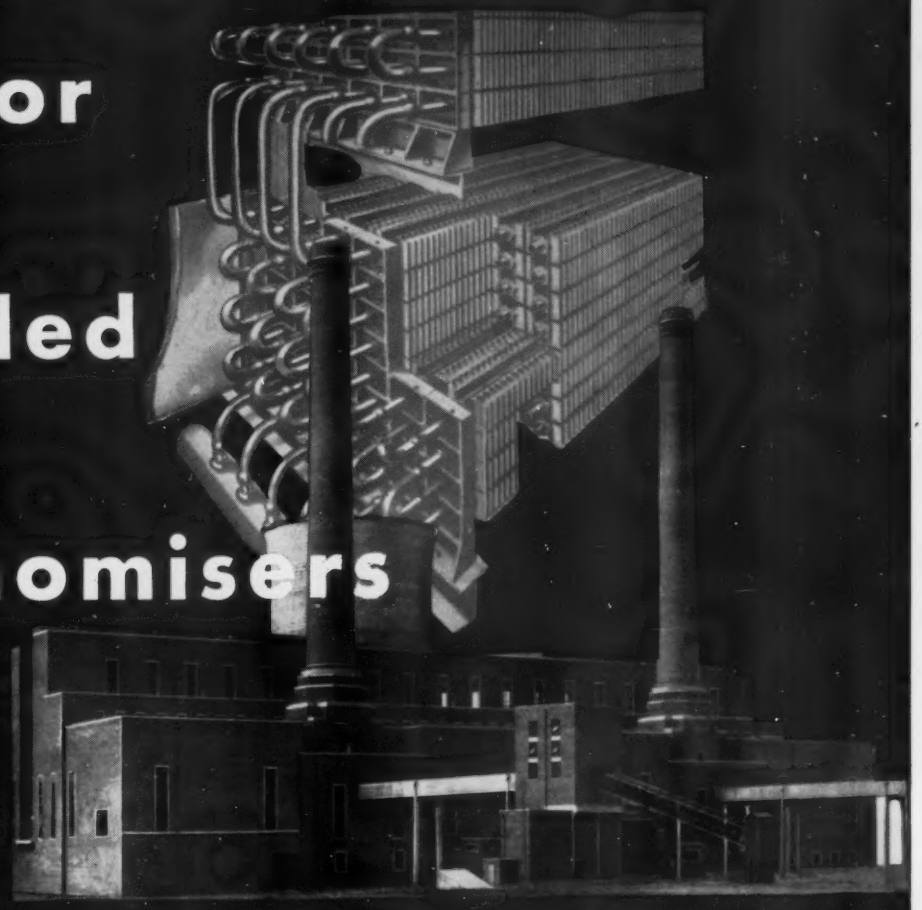

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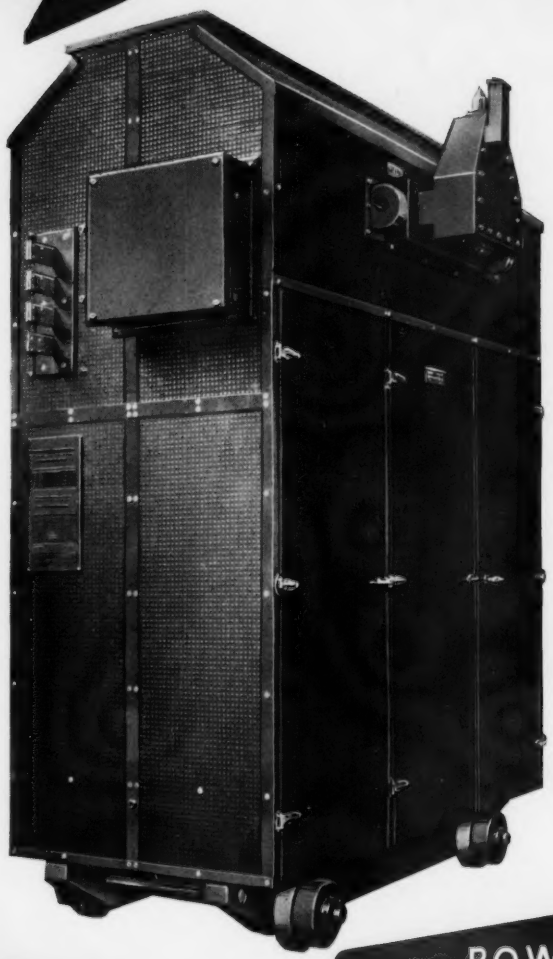

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